IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:	)	
	)	
PENG LEE and KEVIN SEDDON	)	
	)	
Serial No.: 10/708,571	)	
	)	
Filed: March 11, 2004	)	
	)	
For: NONDESTRUCTIVE RESIDENTIAL INSPECTION METHOD AND APPARATUS	)	Attorney Docket No.: 1038406-000004

AMENDED APPEAL BRIEF

MS-Appeal Brief- Patents
Commissioner for Patents
P. O. Box 1450
Alexandria. VA 22313-1450

Dear Sir:

As required under § 41.37(a), this brief is filed within two months of the Notice of Appeal filed in this case on September 5, 2007, and is in furtherance of said Notice of Appeal.

The fees required under § 41.20(b)(2) are dealt with in the accompanying TRANSMITTAL OF APPEAL BRIEF.

This brief contains items under the following headings as required by 37 C.F.R. § 41.37 and M.P.E. P. § 1205.02:

I. Real Party in Interest
II. Related Appeals, Interferences and Judicial Proceedings
III. Status of Claims
IV. Status of Amendments
V. Summary of Claimed Subject Matter
VI. Grounds of Rejection to be Reviewed on Appeal
VII. Argument
Claims Appendix
Evidence Appendix
Related Proceedings Appendix – NONE

I. REAL PARTY IN INTEREST

The real party in interest is HomeSafe, Inc, a Corporation organized under and pursuant to the laws of the State of Tennessee, and the assignee of this application.

II. RELATED APPEALS, INTERFERENCES AND JUDICIAL PROCEEDINGS

There are no other appeals or interferences that will directly affect or be directly affected by or have a bearing on the board's decision in this appeal.

III. STATUS OF CLAIMS

There are six (6) claims pending in the present application. Claims 10, 26-30 and 60. Claims 10, 26-30 and 60 are rejected. The claims on appeal are 10, 26-30 and 60. Claims 1-9, 11-25, 31-59 and 61 -62 are cancelled. See Claim Appendix.

IV. STATUS OF AMENDMENTS

An amendment under 37 C.F.R. § 41.33(b) is enclosed to correct an error in claim 26.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

The invention disclosed in the `571 application relates to nondestructive residential inspection using an infrared camera to obtain temperature profiles of building components. Enhanced thermal contrast is obtained by two process steps; 1) creating a temperature differential of greater than 10ºF between the inside and the outside of said residential building, and 2) turning on substantially all light switches and substantially exhaust blowers in the residential building. The enhanced contrast facilitates a rapid and accurate inspection of the residence. A variety of problems can be assessed including moisture and electrical deficiencies.

Referring specifically to the basis for the claim language in the disclosure, independent claim 10 will be discussed in paragraph form pointing out the referenced numerals employed to identify the claimed components and the area of specification by paragraph where the components are described.

The method steps include:

"preparing a residential building for inspection by creating a temperature differential of greater than 10ºF between the inside and outside of said residential building," [0070] and [0104];
"turning on substantially all exhaust blowers in said residential building" [0100];
"obtaining temperature profiles of the exterior residential components selected from the group consisting of wall, eave and fascia wherein said temperature profile detects moisture" [0073], [0087];
"obtaining temperature profiles of an interior surface of a pitched roof wherein said temperature profiles detect moisture" Fig. 10B & C [0092];
"obtaining temperature profile of interior residential building components" Figs. 5–31 [0103–0125];
"obtaining temperature profiles of each electrical outlet in the residential building" [0098];
"assessing each of said temperature profiles to detect a thermal anomaly indicative of a problem with said residential building components wherein a said problem can include moisture" [0072] [0073]
"reporting said problem to said designated entity where said steps up to the step and assessing each of said profiles occur within 4 hours" [0066];

Support for claim 26 is as follows:

"preparing said residential building to detect potential electrical problem by turning on substantially all light switches in said residential building; and turning on substantially all exhaust blowers in said residential building; and then" [0100];
"obtaining temperature profiles of substantially all electrical outlets in said residential building" [0098];
"and assessing each of said temperature profiles for an anomaly indicative of an electrical problem, wherein said steps up to the assessing each of said profiles occur within 4 hours" [0102] [0066];

Claim 27. The method of claim 26 wherein said electrical problem is an overheated electrical circuit. [0097] [0100]

Claim 28. The method of claim 26 wherein said electrical problem is contact surface over heat. [0097] [0100]

Claim 29. The method of claim 26 wherein said electrical problem is contact surface over heat. [0097] [0100]

Claim 29. The method of claim 26 wherein said electrical problem is a hot electrical wire within a wall. [0097] [0100]

Claim 60. The method of claim 26 further comprising the step of measuring temperature of substantially all electrical outlets. [0101]

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claim 10 is rejected under 35 U.S.C. I03(a) as being unpatentable over the ASTMC 1060-90 standard titled "Standard Practice for Thermographic Inspection of insulation Installations in Envelope Cavities of Frame Buildings" in view of the publication titled "InfraMation 2002 (262 pages) - Table of Contents" [hereinafter InfraMation][1] and the publication titled "100's of Tips on Saving Energy and Money at Home" (www.mississauga4sale.com/newsletter/energy_saving_tips.htm) by Argentino.

Claims 26-30 and 60 are rejected under 35 U.S.C. 103(a) as being unpatentable over ASTM-C1060-90 in view of Argentina and the publication titled "Infrared Inspection: Sample Home Inspection" by Boldstar.

[1] The InfraMation document has not been cited in a 1449 form by either the Applicant or the Examiner.

VII. ARGUMENT

A. The Finality of the Rejection of Claim I0 Should be Withdrawn

In response to the February 12. 2007 Office Action, Applicant amended the pending independent claims to more particularly point out the invention. In order to rapidly inspect (in 4 hours or less) a residential building certain procedures are required to prepare the residential building for inspection. The use of these procedures yield sufficient contrast in. the temperature profiles to allow for rapid inspection. Claim 10 has been amended to recite that the residential building is prepared for inspection and then the temperature profiles are obtained. The temperature profile can be assessed to detect a thermal anomaly indicative of a problem. This problem can include an electrical problem, a problem with insulation or a structural problem leased moisture content

The Court of Appeals for the Federal Circuit has explicitly addressed § 103 and followed the approach the Supreme Court set forth for applying that provision. Section 103 provides, in pertinent part:

> A patent may not be obtained...if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

35 U.S.C. § 103(a).

The Supreme Court in *Graham* held that:

> While. the ultimate questions of patent validity is one of law, the § 103 condition, which is but one of three conditions, each of which must be satisfied, lends itself to several basic factual inquiries. Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the

> circumstances surrounding the origin of the subject matter sought to be patented. As indicia of obviousness or nonobviousness, these inquires may have relevancy.

Graham v. John Deere, Co., 383 U.S. 1 (1966).

Thus, under *Graham,* the obviousness inquiry is highly fact specific, and requires an examination of the following: (I) the scope and content of the prior art; (2) the differences between the patented invention and what already existed in the prior art; (3) the ordinary level of skill of people working in the field; and (4) other objective evidence which may suggest that the invention would not have been obvious. The Court also warned lower courts to "guard against slipping into use of hindsight, ...and to resist the temptation to read into the prior art the teachings of the invention in issue." 383 U.S. at 36. *See also Ashland Oil, Co. v. Delta Resins & Refractories, Inc.*. 776 F.2d 281, 291 (Fed. Cir. 1985), *cert. denied* 475 U.S. 1017 (1986).

> [R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness"). As our precedents make clear, however, the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and created steps that a person of ordinary skill in the art would employ.

KSR International Co. v. Teleflex Inc., 2007 WL 1237837 (Sup. Ct. 2007).

Additionally the invention also may not be rendered obvious, unless the prior art is sufficiently enabling. *Motorola, Inc. v. Interdigital Technology Corp.*, 121 F.3d 1461, 1471 (Fed. Cir. 1997); *Beckman Instruments, Inc. v. LKB Produkter AB*, 892 F.2d 1547, 1551 (Fed. Cir. 1989).

The rejection of pending claim 10 as unpatentable under 35 U.S.C. § 103(a) is respectfully traversed because there is no rational underpinning for the examiner's legal conclusion of obviousness.

The primary reference cited by the Examiner is an ASTM document relating to thermographic insulation installations, The Examiner has read more into the ASTM document than is disclosed and at times edited the ASTM document to help make the case for obviousness. This is apparent from a comparison of the statements in the ASTM document and the Examiner's statements.

The Examiner notes that ASTM-C1060-90 "discloses a method of inspecting building components." ASTM-C 1060-90, however. discloses standard practices for thermographic inspection of insulation installations in envelope cavities of frame buildings.

The Examiner notes that ASTM-01060-90 discloses: "preparing a building for inspection by creating a temperature differential of **greater than 18**° F between inside and outside of the building for a period of time." However, the Examiner fails to state that the ASTM document provides that the period of time is "four hours prior to the test." The Examiner also fails to state that the claimed temperature differential is **10°F**, not 18°F as disclosed by the ASTM document.

The Examiner notes that ASTM-C1060-90 "does not disclose the particular interior components, obtaining temperature profiles of each electrical outlet in the building, the preparing step including turning on all light switches and exhaust blowers in the building and the temperature profiles detecting moisture."

Additionally, the Examiner fails to report that ASTM-C1060-90 does not disclose:

1) preparing a residential building for inspection by reacting a temperature differential of greater than 10°F between the inside and outside of the residential building.

Importantly, the primary reference does not disclose the claimed process steps to prepare the residence for inspection. If these claimed process steps are taken. then the inspection can be

completed within four hours. This is a surprising and unexpected result, as the ASTM-C1060-90 teaches, away from the claimed process steps and the completion of the test within four hours. Indeed, the disclosure in ASTM-01060-90 is very good evidence for why the claimed invention is nonobvious because the claimed process should not work in view of the disclosure in the ASTM document.

To further make a case of obviousness, the Examiner provides the Argentino reference. Argentina only states that "infrared cameras" can be used in an energy audit. This document is not enabling and provides no substantive information with respect to the claim elements. Argentino only states that ". . . infrared cameras . . . to find inefficiencies that cannot be detected by a visual inspection." No further examples or specifics are disclosed with respect to the conditions or components that can be detected with infrared. As the Court of Appeals for the Federal Circuit has stated multiple times before, an invention also may not be rendered obvious unless the prior an is sufficiently enabling *Motorola, Inc. v. Interdigital Technology Corp.,* 121 F.3d 1461, 1471 (Fed. Cir. 1997); *Beckman Instruments, Inc. v. LKB Produkter AB*, 892 F.2d 1547, 1551 (Fed. Cir. 1989).

Next, the Examiner cites to InfraMation.

> "Applicant's arguments regarding the. amount of time it takes to perform the test. i.e. within four hours are moot in view of the new grounds for rejections."

6-14-07 office action at p.8.

The Examiner cited to the InfraMation document to show that InfraMation discloses that it is known in the art the infrared thermography, *i.e.*, thermal imaging/profiling, is used to inspect building envelopes by detecting both moisture and air leakage {see last page, title: "Nondestructive testing of building envelope systems using Infrared thermography" by Snell).

Applicant objects to the use of prior art not made of record to support an assertion of obviousness. Without a copy of the document, neither Appellant, nor the public can discern the true scope of the prior art.

The Examiner's arguments with respect to obviousness further confirm a lack of understanding of the technology. "Air must be flowing through the ducts in order to determine if there is a thermal anomaly in the ducts" is completely erroneous. The blowers are turned on to create an electrical load to create thermal contrast which can be detected at the electrical outlet.

The presently claimed method for residential inspection is rapid, i.e., occurs within four hours. This element is not disclosed or suggested by the cited prior art. The presently claimed invention requires certain steps to put the residential building in condition for rapid inspection. These elements are not disclosed or suggested by the prior art. The presently claimed invention identifies a variety of problems: moisture, lack of insulation and electrical problems. Again these elements are not shown in the cited art.

The ASTM method only relates to the detection of insulation. Indeed the document is clear on this point – infrared may be useful in other areas outside of the inspection of insulation but "their interpretation may require procedure and techniques not presented in this practice." The Argentino reference does not disclose or suggest any limitation because it is not enabling. A reasonable chance of success must exist. The Lee Declaration shows what is possible if the method is practiced within the parameters of the invention. These possibilities were not recognized in the cited references. It is only based upon the Appellant's disclosure that the claimed invention is known. Additionally, this technology has the indicia of nonobviousness in that there was a long felt need in the industry to develop such comprehensive, fast and reliable scans. 132 Declaration by Bruce Thomas.

The Examiner's conclusion of obviousness with respect to Claim 10 is not based on evidence of record. The conclusion of obviousness misstates the factual element present in the art, ignores elements in the claims and disregards the evidence submitted in the 132 declarations. Consequently, Appellant respectfully request that the finality of obviousness rejection be withdrawn with respect to claim 10.

B. The Finality of the Rejecting of Claims 26-30 & 60 Should be Withdrawn

Claims 26-30 and 60 are rejected under 35 U.S.C. § 103(a) as being unpatentable over ASTM-CI060-90 in view of Argentino and the publication titled "Infrared Inspection: Sample Home Inspection" by Boldstar.

Claims 26-30 and 60 are directed to a method to detect potential electrical problems in a residential building. To obtain sufficient thermal contrast certain process steps are required:

"turning on substantially all light switches and substantially ail. exhaust blowers"

Oddly, the Examiner cites to ASTM-CI060-90 relating to inspection of insulation as the primary prior art reference. The disclosure in ASTM-CI060-90 is completely unrelated to the claimed method (26-30 & 60). To supply the deficiencies in ASTM-C1060-90, the Examiner cites to Boldstar. Boldstar does not disclose any procedures relating to the thermal inspection. Boldstar does disclose that an electrical panel can be inspected for electrical thermal anomalies. The present application does not relate to inspecting an electrical panel, but rather outlets (if the claimed thermal load is generated according to the claimed process steps).

Although, none of the claimed elements are disclosed in the cited reference (and contrary to the evidence submitted in the 132 declarations) the Examiner concludes that the invention would be obvious to one skilled in the art, "Turning on lights will all help to obtain a more accurate temperature profile of the energy efficiency of the building." The claims are not related

to energy efficiency. The Examiner does not really appear to have an understanding of what is claimed and thus, can't provide a meaningful assessment of the prior art. In fact, the Examiner's assertions with respect to why one skilled in the art would use these process steps prior to an inspection, show why this assertion is wrong.

> In this case, the cited prior art teaches obtaining temp re profiles of all of the electrical outlets and ducts when inspecting the interior components of the building, and assessing the profiles of the electrical outlets and ducts for an anomaly indicating an electrical problem to determine if the circuits are overheating and to determine if the ducts are leaking, respectively, wherein turning on substantially all light switches and substantially all exhaust blowers in the building ducts when doing such tests is within the knowledge that is generally available to one of ordinary skill in the art since it must be performed in order to inspect the electrical outlets and ducts without having to move from area to area turning each outlet and duct on, i.e., saves time to turn them all on at once and inspect them while they are all on.

10/708,571, June 8, 2006 office action at p. 8

It is noted that the step of "turning on substantially all light switches and substantially all exhaust blowers in said residential building" is related to providing an increased electrical load to increase **the contrast** of the thermal image at each electrical outlet so that the inspection can be rapidly completed.

The Examiner has presented no factual basis for the assertion that the two claimed process steps were within the knowledge of one skilled in the art. First, Boldstar relates to electrical panel inspection. It does not relate to electrical outlets. The present application relates to the inspection of the numerous electrical outlets in a residential structure.

Appellant respectfully request that the finality of the obviousness rejection of claims 26-30 & 60 be withdrawn because a reasoned statement grounded in the Graham inquiries has not been made by the examiner.

Respectfully Submitted,

Baker, Donelson, Bearman, Caldwell & Berkowitz, PC

02/13/2008
Date

By:_____
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CLAIMS APPENDIX

Claims on Appeal:

Claims 1-9 (canceled).

Claim 10 (previously presented) A method to rapidly inspect residential building components for a designated entit[y] comprising the steps of:

preparing a residential building for inspection by creating a temperature differential of greater than 10°F between, the inside and the outside of said residential building and turning on substantially all light switches and substantially all exhaust blowers in said residential building; and then

obtaining temperature profiles of the exterior residential buildin[g] components selected from the group consisting of wall, cafe and facia wherein said temperature profiles detect moisture;

obtaining temperature profiles of the interior surface of a pitched roof wherein said temperature profiles detect moisture;

obtaining temperature. profiles of the interior residential building components;

obtaining temperature profiles of each electrical outlet in the residential building;

assessing each of said temperature profiles to detect a thermal anomaly indicative of a problem with said residential building components wherein said problem can include moisture; and

reporting said problem to said desi[g]nated entity wherein said steps up to the step of assessing each of said profiles occur within 4 hours.

Claims 11 - 2 5 (canceled).

Claim 26 (currently amended) A method to detect a potential electrical problem in a residential building comprising the steps of:

preparing said residential building to detect a potential electrical problem by turning on substantially all light switches in said residential building; and turning on substantially all exhaust blowers in said residential building; and then

obtaining temperature profiles of substantially all electrical outlets in said residential building; and assessing each of said temperature profiles for an anomaly indicative of an electrical problem, wherein said steps up to the step of assessing each of said profiles occurs with in 4 hours.

Claim 27 (original) The method of claim 26 wherein said electrical problem is an overload of an electrical circuit.

Claim 28 (original) The method of claim 26 wherein said electrical problem is contact surface over heat.

Claim 29 (original) The method of claim 26 wherein said electrical problem is hot electrical wire within a wall,

Claim 30 (original) The method of claim 26 wherein said temperature profiles arc recorded on a digital recording device,

Claim 31 - 59 (cancelled)

Claim 60 (previously presented) The method of claim 26 further comprising the step of measuring the temperature of substantially all electrical outlets.

Claim 61 - 62 (cancelled)

RELATED PROCEEDINGS APPENDIX

NONE

EVIDENCE APPENDIX

EXHIBIT 1 – DECLARATION OF RICK HYNUM

The Declaration of Rick Hynum was received by the USPTO on 04/17/2006. The Examiner discussed the Declaration at Paragraph 6 of the 06/08/2006 Office Action.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPL. NO.:	10/708,571
APPLICANT(S):	Peng Lee
FILED:	March 11, 2004
TITLE:	NONDESTRUCTIVE RESIDENTIAL INSPECTION METHOD AND APPARATUS
TC/A.U.:	2859
EXAMINER:	JAGAN, Mirellys
DOCKET NO.:	026018.50271

DECLARATION UNDER 37 CFR § 1.132

I, Rick Hynum, hereby declare that:

1. I, Rick Hynum, am the Vice President of Communications for HomeSafe Inspection, Inc. which is the owner by assignment of all of the rights, title, and interests in this patent application.

2. As evidenced by the documents appended hereto, there has been a long-felt need in the industry and professional approval of the presently claimed invention.

3. Appendix tab A: This is a selection from an article in the *Houston Community Newspapers* dated March 10, 2005. The title of this article is *Safeguard: Houston Company Revolutionizes Home Inspection Process*. In this article, the owner of Top Guns Realty, the county's largest independent real estate office, states the infrared and acoustic technology used by HomeSafe is "the greatest thing since sliced bread." This description of the invention shows that it is new in the industry and satisfies a long-felt need in the industry for such a product.

4. Appendix tab B: This article is from *The Daily Journal*, dated July 13, 2003, entitled "A Better Mousetrap." This article states that "because HomeSafe has previously untapped talent for pointing out flaws, some people in the home selling process might flinch at so detailed an inspection. But the company's CEO said HomeSafe often turns the table in the opposite direction."

5. Appendix tab C: Gadgets and Gizmos, The Communicator Magazine Winter 2004, notes that "We've gathered up some of the latest and greatest so that you can see what's new in 2004 . . .". The author reviews the HomeSafe process as one of the latest and greatest.

6. Appendix Tab D: This is an article in the Commercial Appeal dated April 26, 2004. It is noted that "While infrared technology isn't new to the home inspection business, it's never been as mobile or paired with the acoustic component HomeSafe offers."

In the same article Don Merritt, the president of the American Society of Home Inspectors states that: "Infrared has been around forever," (Don Merritt, president of the American Society of Home Inspectors) said, "but it used to require 20 to 30 degrees difference in temperature to get a good reading."

7. Appendix Tab E: This is an article from The Clarion Ledger, July 29, 2003, in this article it notes that, "Technologically, I'm quite impressed because they've shown moisture in a wall that roofers said they've fixed three times," said (Bill)_ Ridgway, secretary and treasurer of (Ridgway Management, Inc.). Despite the roofer's best efforts, the infrared scanner found the moisture because it can pick up things human eyes cannot see. "It allows us to see what we heretofore have not been able to see," Ridgway said.

8. Appendix Tab F: This is an article from the Oceans Springs Record dated March 11, 2004, entitled HomeSafe Inspection Takes Home Inspections to a New Level. In this article, it is stated that: "HomeSafe Inspection takes home inspections to a new level. The high-tech business uses infrared technology, listening sensors and traditional visual techniques to give clients the most comprehensive reports available on their homes."

9. Appendix Tab G: This is an article from the Northwest Florida Daily News, dated December 5, 2004, entitled Headline: Inspections Superman-Style. "Agent Robbie Fenn of RE/MAX Southern Realty likes the added protection offered by Phillips' sophisticated equipment. It takes the liability off of me," she said. "And (knowing of the defects) benefits both the buyer and the seller."

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The Villager

HOUSTON COMMUNITY NEWSPAPERS

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Business

Safeguard: Houston company revolutionizes home inspection process

By: HOWARD RODEN, HCN/ Courier staff 03/10/2005

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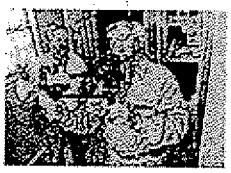

Photo by Jerry Baker

Long before the advent of X-ray and MRI machines, a doctor could only prod, probe and sometimes cut into his patient in order to learn the precise nature of an illness.
In many respects, home inspections today rely on that same methodology.
When checking the worthiness of a home, quality inspectors do a thorough visual inspection. They root around in its nooks and crannies, looking for tell-tale signs that may - or may not - indicate a problem in the roof, with the foundation or in the electrical or plumbing systems.

Long before the advent of X-ray and MRI machines, a doctor could only prod, probe and sometimes cut into his patient in order to learn the precise nature of an illness.
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When checking the worthiness of a home, quality inspectors do a thorough visual inspection. They root around in its nooks and crannies, looking for tell-tale signs that may - or may not - indicate a problem in the roof, with the foundation or in the electrical or plumbing systems.
Occasionally, inspectors will perform "exploratory surgery" on a house to confirm a suspicion, such as an

infestation of termites. But in most cases, inspectors have been limited by their inability to see and hear through walls.

Not anymore.

Thanks to a former University of Mississippi scientist, home inspections are finally entering the 21st century. Peng Lee developed a revolutionary system of customized infrared cameras, an ultra-sensitive acoustic sensor and sound recognition computer software that has removed virtually all of the guesswork from home inspections.

With Lee's technology, a home inspector literally can "see through walls." The infrared cameras detect variances in temperature that can reveal "hot spots" due to faulty electrical wiring or an accumulation of moisture. The moisture could be evidence of a water leak, mold or termites.

The listening device, which contains a needle-like probe that can be inserted into sheet rock without discernable damage, confirms the presence of termites and other pests.

But this technology isn't restricted to the laboratory. Lee, along with fellow Ole Miss alum Kevin Seddon, formed HomeSafe Inspections Inc. in 2003, and their company has blossomed like a Mississippi magnolia, with franchises and licensees in 19 states, including Texas. Since Lee invented his device while at the University of Mississippi, the school receives a portion of HomeSafe's franchise and licensing fees.

HomeSafe has both franchises and a corporate-owned unit in Houston, and the company is looking to expand in this market.

"Houston's real estate market is healthy and growing," said Seddon, who is HomeSafe's president. "It's a great fit for us."

Montgomery County, with its current boom in residential construction, is an attractive target, said Van Vanlandingham, sales director for HomeSafe's Houston office.

"Our technology helps both the seller and the buyer (of homes)," he said. "Presale inspection helps the seller know the exact condition his home is in, and if there is any need to repair any damage our inspections detect. The buyer is protected because he has a complete, detailed report on the home's condition. It's a true win-win situation."

No one knows that better than Bill McIlwain, a co-owner of Prudential Gary Greene Realtors, one of Houston's largest real estate companies. McIlwain became aware of HomeSafe about 18 months ago when he and Vanlandingham had a chance encounter on the golf course.

McIlwain was looking to purchase a 4,850-square-foot home that had been empty for five years.

"I was buying it for my personal use, and it was a large home with a lot of leaks and potential problems," he said. "I wasn't sure I wanted to buy it until I knew just how extensive the problems were."

A high-tech HomeSafe inspection revealed the problems were not as detailed as McIlwain had feared.

"Last June, I was looking at buying a home as a rent house," he said. "It also had some leaks, but they

(HomeSafe) came out and their inspection made me realize there were no major problems. The problems were easy to fix, and I quickly rented the home."

As a satisfied customer, McIlwain has encouraged members of the Gary Greene sales force to embrace the new technology. Nikki Owen, sales manager at Gary Greene's Fort Bend County office, recently hosted a HomeSafe demonstration for about 50 agents.

"It really is the wave of the future," she said. "We would certainly recommend to any buyer and seller. The more information a buyer can have about a house, the better off they're going to be."

A comprehensive inspection like HomeSafe's reduces the threat of lawsuits, Owen said.

"This allows any concerns about the home to be brought to the forefront and become resolved before any sale," said Owen, adding that "many" of her agents have begun recommending HomeSafe inspections to buyers.

Although HomeSafe has yet to reach Montgomery County, local broker Keith Robertson is eager for a demonstration. Owner of Top Guns Realty, the county's largest independent real estate office, Robertson believes the infrared and acoustic technology used by HomeSafe is "the greatest thing since sliced bread."

"I'd like to talk with them about that," he said. "That kind of technology is spectacular."

Spectacular is an apt way to describe how Lee's system - which is patent pending - works. Infrared technology is nothing new; it has been used in the U.S. military for decades. But many of those systems require a temperature difference of 20-30 degrees.

HomeSafe's infrared unit, which is manufactured by Raytheon, works in an environment with no more than a 10-degree temperature difference. The camera is so sensitive at detecting heat transference, a hand placed on a wall for as little as five seconds leaves a clearly defined handprint on the camera's monitor.

If the camera is aimed at a wall long enough, wall studs and even nail heads in the sheet rock are discernable, said Mike Poth, one of HomeSafe's Houston inspectors.

"We've completed an inspection on one existing home where we discovered there wasn't one piece of insulation in the walls," Poth said. "But the most important discovery is fire safety. A lot of times, people don't realize a dimmer switch is overheating and could start a fire."

That is why Poth and fellow inspector Gus Smith recommend periodic preventative home inspections.

"The only time most people do a home inspection is when they buy a house," he said. "That's like going to a doctor once in your lifetime and assuming you'll never get sick."

Smith stressed that HomeSafe's technology does not replace the conventional home inspection methods, but merely enhances them.

"A conventional home inspection can see about 33 percent of the home. Our inspections exposes at least another 30 percent," he said. "A lot of the time, our technology merely confirms what our visual inspection suggests."

A HomeSafe inspection takes an average of 2 1/2

hours, and rates for an inspection start at $200 for a home up to 2,000 square feet (including garage). HomeSafe's rates are comparable to those of a conventional inspection, Robertson said.

HomeSafe also donates a portion of its Houston inspection fees to Houston-based Sunshine Kids.

Business is booming for HomeSafe, and not just because of its revolutionary technology. Money Magazine rated the home inspection industry as one of the "Top 10 Highest Income Home Businesses (over $100,000 per year)" and among "America's 50 Hottest jobs."

Vanlandingham said franchises are available in the Houston area, with $12,000 as the normal startup fee. "With one franchise for every 40,000 households, we're definitely looking for inspectors," he said. "Once the word gets out, everyone will want this type of inspection."

For more information about HomeSafe and its infrared technology, call Vanlandingham at (713) 858-2708 or Gus Brandt, professional inspector, at (281) 481-2580, or visit www.homesafeinspection.com.

Howard Roden may be reached at hroden@mail.hcnonline.net.

B

Daily Journal
NORTHEAST MISSISSIPPI

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A better mousetrap

7/13/2003 8:14:28 AM
Daily Journal

BY GARY PERILLOUX

Daily Journal

OXFORD - What distinguishes HomeSafe's method of home inspection from other approaches?

"We have a better mousetrap," says inventor Peng Lee.

And mice are one thing Lee knows how to find.

On a recent morning-long inspection, Lee pointed his infrared camera upward and there, in the attic's pink insulation, nestled the furry forms of rodents. Baiting, traps and barring access points are potential mousetrap solutions to a common problem.

Lee points out "$10 problems" but says he's most interested in detecting the potential $5,000 problems that can save parties to a home transaction lots of time, grief and money down the road.

Lee's "Ghostbusters"-like battery of cameras, sensors, ultrasound microphones, Pocket PCs and

pattern-recognition software take human error out of the process to the extent technology allows.

"The software will make the call," Lee says. "So I take the human error out of it."

But human intelligence in the form of state-licensed inspectors who go through additional HomeSafe training is essential to the process. Visual inspections, flashlights, deductive reasoning and homeowner counseling are part of the inspection process.

"I'm a scientist," Lee says. "I want to find the reason behind (the problem). We use the technology back and forth in a home inspection."

Inside walls, Lee's infrared camera can pinpoint sources of heat-loss and acoustic sensors can hear termites crunching. On the recent inspection, Lee eliminated one heat-loss situation by noting cold air coming from a floor register.

Water stains near a window turned out to be superficial, with no sound of termites in the wall. He did pick up "hot spots" at wall receptacles where wiring standards weren't up to the load they were carrying and recommended electrical work to prevent a fire.

In a second-floor attic with finished floors and walls, Lee recommended carbon-monoxide detectors because a gas hot-water heater inhabited the living space there.

Because HomeSafe has previously untapped talent for pointing out flaws, some people in the home-selling process might flinch at so detailed an inspection. But the company's CEO said HomeSafe often turns the table in the opposite direction.

"We've saved so many deals," Kevin Seddon said. "The more you know, the better off everybody is."

One grand old Oxford home sat on the market for years, rejected multiple times by buyers after visual inspections led to conjecture about a bad roof.

"We went to the house, shot the infrared up through the ceiling and there was no water, no moisture (at the roof level)," Seddon said.

At a lower level, though, moisture from an overhead uninsulated air duct had dripped through and stained the ceiling. After $300 of insulation, the house was cleared for a sale.

"That house didn't sell for three years because people thought the roof was bad," Seddon said.

Appeared originally in the Northeast Mississippi Daily Journal, 7/13/2003 8:00:00 AM, section F , page 1

C

HOMESAFE INSPECTION™

Gadgets and Gizmos

The Communicator Magazine
Winter, 2004

Gadgets and Gizmos: What's New for 2004

As the New Year gets off to a speedy start, an assortment of new products are being introduced to the industry. We've gathered up some of the latest and greatest so that you can see what's new in 2004...

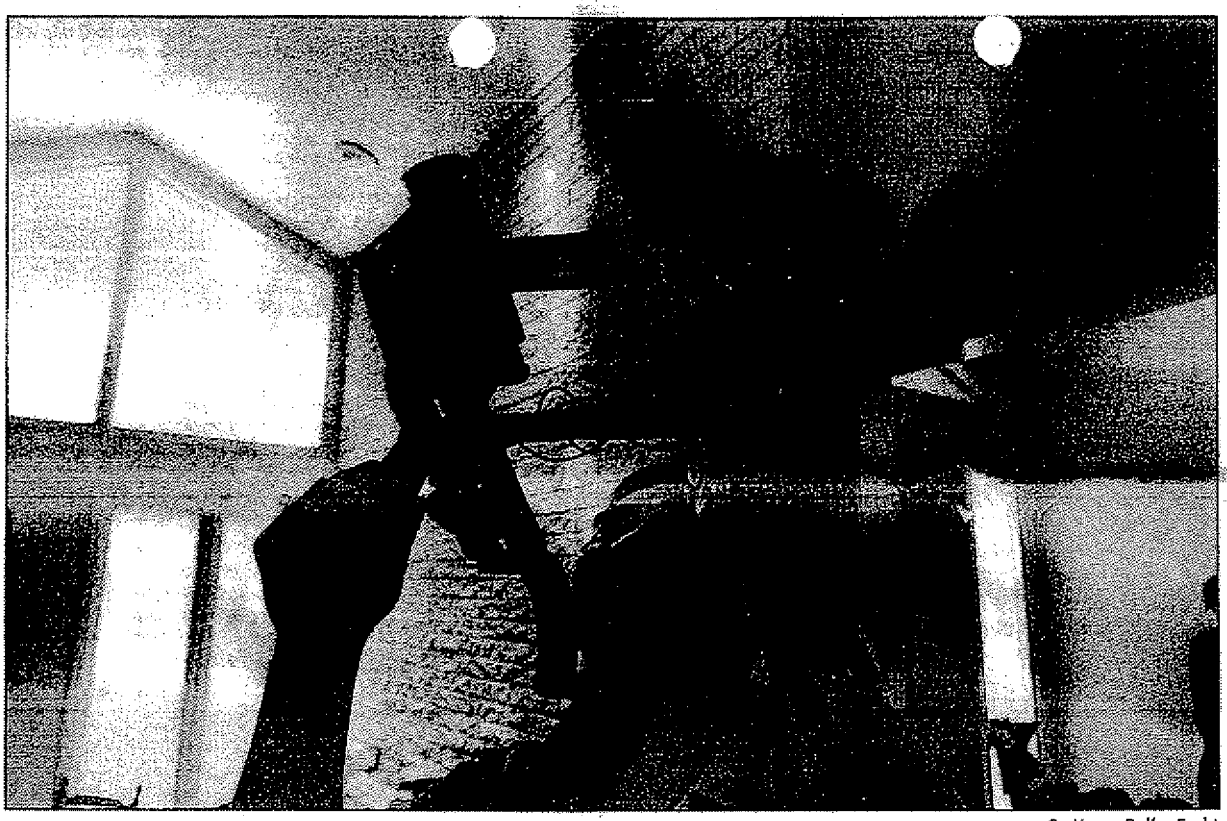
...HomeSafe Unveils New Technology for Home, Termite Inspections

Oxford, Mississippi based HomeSafe Inspection, Inc. has developed a new home inspection technology that allows an inspector to virtually "see" and "hear" through a house's walls, floors and ceiling, uncovering signs of damage and potential problems that likely would go undetected in an ordinary visual inspection. The HomeSafe technology combines advanced thermal imaging (infrared) and acoustic (listening) sensors along with a PocketPC equipped with specially designed software.

The inspection process begins with a thorough infrared scan of the property's walls, ceilings, floors, plumbing and wiring. Differences in temperature show up as thermal variations, which provide the inspector with vital information about problems like energy loss, faulty wiring, water damage, roof and pipe leaks and structural deficiencies.

In addition, an infrared scan may detect signs of moisture which suggest the possibility of termites. In that case, HomeSafe employs its high-tech acoustic sensors (patent pending) which can actually detect termite noises that the human ear cannot hear. If questionable noises are detected, the signals are fed into a PocketPC equipped with specially developed pattern recognition software (patent pending) that recognizes and identifies termite sounds. The result: If termites are there, the inspector will almost always be able to "hear" them and pinpoint their exact location for better treatment. HomeSafe's technology has been reviewed by leading scientists in the areas of termite and pest control. For more information call (866) 327-7233 or visit **www.HomeSafeInspection.com**.

D



Peng Lee, of HomeSafe Inspection, uses his thermal imaging camera during a home evaluation. His infrared and acoustic sensor technology allows inspectors to see and hear through the walls, floors and ceilings, uncovering flaws mere visual inspection may miss such as hidden water leaks, faulty wiring, termites and even places where energy is being lost. HomeSafe now has three franchises in Shelby County.

By Karen Pulfer Focht

New insight on inspections

HomeSafe sensors detect flaws

By Jane Roberts

robertjs@commercialappeal.com

Home inspectors have only two eyes like the rest of us, and when it comes to buying a home, lots of people would pay for deeper insight.

HomeSafe Inspection uses infrared and acoustic sensors to see and hear through the walls, floors and ceilings, uncovering flaws mere visual inspections may miss. — water leaks, faulty wiring — even places where energy is being lost.

Termites are a dead giveaway. In HomeSafe's acoustic equipment, they sound like an army gnawing on Fritos.

"That sound is very disturbing to homeowners," said Kevin Seddon, president of the Oxford, Miss.-based HomeSafe. "When they hear that, they say, 'How long do I have?'"

While infrared technology isn't new to the home inspection business, it's never been as mobile or paired with the acoustic component HomeSafe offers.

Peng Lee, HomeSafe's vice president of technology, originally developed it at the National Center of Physical Acoustics at the University of Mississippi for pest control. Seddon quickly saw the potential in the home inspection market.

"We can find structural problems and insulation deficiencies," he said. "We can find mice and rats. We've been called in to find raccoons stuck and skunks stuck in vents."

In Shelby County, HomeSafe charges about $300 to inspect a 2,000-square-foot home, said Margaret King, director of sales.

For an annual home protection plan, HomeSafe charges $150 for the same square footage, testing homes for hazards to children or senior citizens.

"We'll come back up to three times in a year," King said. "So if a storm hits and people think they've got a leak, they can find out for sure."

HomeSafe is making a buzz in real estate. It's on the Crye-Leike referral list, and longtime broker Ed Beasley is getting calls.

"I'd be inclined to call these people in if a problem shows up on a routine inspection," he said.

Don Merritt, president of the American Society of Home Inspectors, said the industry has long used technology, including ultrasound tests.

"Infrared has been around forever," he said, "but it used to require 20 to 30 degrees' difference in temperature to get a good reading."

It doesn't anymore.

If the average home inspector can see 33 percent of the home, infrared capacity exposes another 30 percent, Seddon said.

"This has saved many, many house deals because it can ascertain the extent of the damage," he said. "If you have a stain in the ceiling, through our technology, we can tell you if it's an active leak or track the moisture back to its source. A drop of water will show."

Last week, drops of water showed as dark blobs in a steady dribble from the front door to the kitchen at Susan and Phil Fentress's home in East Memphis.

Lee expected it was saliva from a family dog.

"Being able to see through one more layer is a tremendous advantage," Lee said.

The Fentresses hired HomeSafe to make an infrared swoop of their 2,800-square-foot home.

"We've done a quite a bit of renovation, and we don't really know if the electrical work was done correctly," Susan Fentress said.

Wiring in the downstairs bathroom showed up perfectly — running in a straight, glowing line from outlet to fixture — and cool, too.

The studs in the walls were as even and strong as ribs in the ark. No water was accumulating or had accumulated under the sinks.

But Lee found what looked like mice nests in the ceiling, a widening moisture seepage in a downstairs closet and loose insulation, accounting for what the Fentresses say are high MLG&W bills.

The technology works by reading heat-absorption levels, showing a hot white glow where electricity escapes harmlessly around light sockets. In a corner, the clothes dryer — cooling after a load of wash — glowed like small refrigerator with the door left open.

It took Lee and another technician 2½ hours to inspect the home, which included a thermal scan, a visual inspection and an acoustic scan.

In a year, Seddon has sold 30 franchises in the tri-state area — including three doing business in Shelby County — plus a scattering of outlets in Alabama, Florida and Oklahoma in a business he expects to break wide open.

In three years, he estimates HomeSafe will have more than 200 franchises, based on sales now. Each franchisee must be certified by the American Society of Home Inspectors and complete HomeSafe's six-day training.

HOMESAFE INSPECTIONS

- **Top executive:** Kevin Seddon, president
- **Business:** Home inspection
- **Corporate office:** 604 S. 16th St., Oxford, Miss.
- **Local Franchises:** Olive Branch, (662) 404-6631, Memphis 753-5858, Oxford, Miss. (662) 236-1232
- **Web site:** *www.homeSafeInspection.com*

"Being able to see through one more layer is a tremendous advantage."
— Peng Lee

E

Revolutionizing home inspections

Infrared scanner sees what eyes can't

By Arnold Lindsay
alindsay@clarionledger.com

Bill Ridgway thought the termites were gone and the leaking roof was fixed.

But an infrared scanning device and acoustic sensors showed problems still existed at the 76-year-old Capitol Street building in Jackson that houses Ridgway Management Inc.

The device, which Peng Lee began developing when he was researcher for the University of Mississippi National Center for Physical Acoustics, allows inspectors to stare through most walls and floors, much like an X-ray. The equipment can spot termites, view electrical wiring, and detect moisture and other pests.

"Technologically, I'm quite impressed because they've shown moisture in a wall that roofers said they they've fixed three times," said Ridgway, secretary and treasurer of the company.

Despite the roofer's best efforts, the infrared scanner found the moisture because it can to pick up things human eyes can not see.

"It allows us to see what we heretofore have not been able to see," Ridgway said.

The patented technology is used by Oxford-based Homesafe Inspection Inc.

Lee began working on the device while at Ole Miss and finished it after becoming co-owner of HomeSafe Inspection.

"My goal is to see the homeowner get the best service," said Lee.

Lee estimates as much as $700,000 was spent by the school to develop the technology. In exchange, Ole Miss will receive royalty payments from a portion of the proceeds home inspectors earn on the device. The school also holds the patent.

HomeSafe Inspection charges field inspectors a one-time $20,000 licensing fee for the device and a 10 percent royalty fee on each home inspection performed. The portion of the royalty that is returned to Ole Miss is used for research in other areas, a spokesman said.

Joe Ellis/The Clarion-Ledger

Pam Pybas and Peng Lee of HomeSafe inspection service of Oxford use an infrared sensor to screen problems such as moisture behind walls Monday afternoon in Judy Johnson's home in the Belhaven district of Jackson.

Originally the device was created to detect termites, but it now goes beyond that.

"In fact, we can find rats, mice, termites. We can find a lot of things," said Kevin Seddon, president of HomeSafe Inspection. "We'll see structural concerns, moisture problems."

Ron Brown, owner of Mr. Brown's Pest Services Inc. in Jackson, watched as the device was used at Ridgway Management's building. He said the device has potential.

"This device, under the right conditions, can help show where they are," said Brown, secretary-treasurer of the Mississippi Pest Control Association. "It adds another level of checking. I think overall it's something that will be of use to homeowners — consumers."

Ridgeland home inspector Pam Pybas, the only person trained and licensed to use the device in this region, will start making it part of her regular inspections this week.

It costs an extra $300 to examine a 2,000-square-foot house with the device. The price increases as the size of the structure gets larger.

It takes a little more than two hours to physically inspect a 2,000-square-foot structure, and an additional 30 minutes to electronically peer through the ceilings, floors and walls, she said.

"I'm booked this week already. The word is out," Pybas said. "Why would you not want this."

> The technology works in part by reading the temperature differences inside a wall and allowing inspectors to view "distinctive patterns," left by termites.
>
> Insertion of an acoustic probe into areas where termite habitats have been found gives an audio confirmation of their presence.

Joe Ellis/The Clarion-Ledger

Peng Lee of HomeSafe inspection uses a special sensor to listen for termites at the Judy Johnson home.

So far, nine other inspectors have been licensed or plan to be licensed by Homesafe in Mississippi and surrounding states, Seddon said. He said licensees will have protected areas.

First American becomes Liberty

■ Merger of New Orleans, Jackson banks complete

By Neil Luter Floyd
nlfloyd@clarionledger.com

Call the phone number for First American Bank, the state's only minority-owned bank, and you'll find it's now answered, "Liberty Bank."

"We are now officially Liberty Bank," said Mary Ann Franklin, president and chief executive officer of First American Bank. "We're now calling it Liberty Bank, First American Branch."

New Orleans-based Liberty Bank & Trust Co., one of the 10 largest African-American-owned commercial banks in America, mailed First American Bank shareholders on Monday a letter from Alden J. McDonald, president and chief executive officer of Liberty Bank, to let them know the merger is official and that they can now surrender their stock certificates. Each shareholder will receive $3.30 per share of stock.

Franklin

"It's official but the regulators still have to send us a certificate of merger," McDonald said. He expects to receive the certificate of merger this week.

The merger gives consumers access to larger loans than those available from 10

See LIBERTY, 2C

Amtrak reform plan travels to Congress

The Associated Press

WASHINGTON — The Bush administration says ending Amtrak's monopoly on intercity passenger rail service would result in reliable trains running shorter distances between cities, relieving congestion on highways and at airports.

But such a transformation will require a "leap of faith" that it will work, according to senior Transportation Department officials who briefed reporters about a bill to restructure Amtrak.

RELATED

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F

HomeSafe Inspection takes home inspections to a new level

By MELISSA SCHNEIDER
Staff Writer

HomeSafe Inspection takes home inspections to a new level.

The high-tech business uses infrared technology, listening sensors and traditional visual techniques to give clients the most comprehensive reports available on their homes.

By using a infrared camera, HomeSafe inspectors can see inside walls, ceilings and floors to detect existing problems.

"We can see what no one else can see," said Bob Rushing, a co-owner of the business.

Temperature differences picked up on the camera allow inspectors to detect problems that range from energy loss and electrical issues to water damage and termite activity.

"They have trained us to interpret these (infrared camera images) in a similar fashion that one would interpret X-rays," Rushing said.

After screening for structural problems, moisture concerns, pipe and duct work leaks, insulation deficiencies and a number of other potential problems, inspectors follow up with in-depth visual inspections.

They pay special attention to areas identified as potential problems during the infrared inspection. The traditional visual inspection allows HomeSafe Inspection to determine the causes of moisture, excessive heat and other suspicious conditions.

If the camera detects possible termite activity, HomeSafe inspectors use acoustic sensors to determine if the pests are present.

By pushing a needle-like sensor through the wall or inserting it between the floor and the wall, inspectors can detect termite noises that the human ear cannot hear. Questionable sounds are fed into a PocketPC, and software unique to HomeSafe can recognize and identify them.

"You can hear them chewing on the house," said Ryan Rubenstein, co-owner of the business.

Since the Ocean Springs HomeSafe Inspection franchise opened last month, most of its clients have stemmed from people planning real estate transactions.

"When a person selling a home, it's good a marketing point to have an inspection," Rushing said.

Prospective buyers also benefit from letting HomeSafe perform home inspections.

"We also can ascertain any future expense that may have to go into the home," Rushing said. "They are getting more home inspection for their money. We are the most technologically advanced on the market."

HomeSafe Inspection is Mississippi licensed, insured and bonded, and all inspectors have a minimum of 300 hours of training.

For information, contact Bob Rushing at 257-9445 or Ryan Rubenstein at 257-9585.

Homesafe Inspection

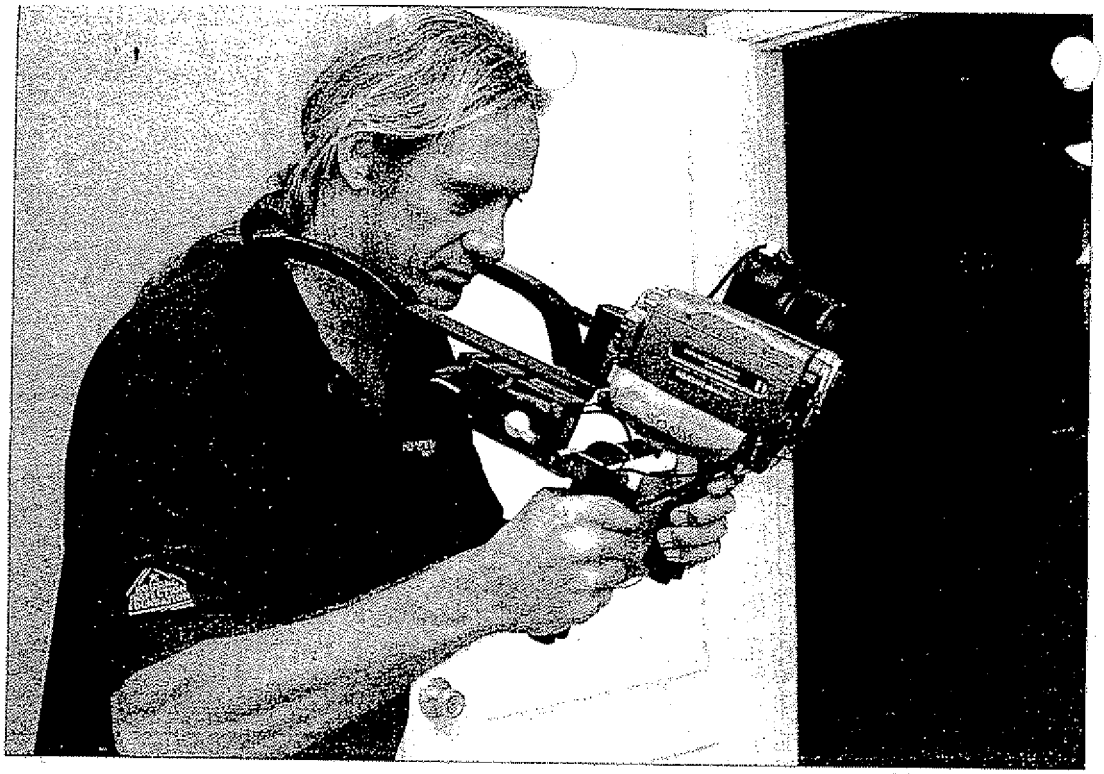
BUSINESS IN A FISHBOWL

Business in a Fishbowl is a weekly feature that focuses on a local business. Each week's business is drawn from our fishbowl of business cards. To enter your business in the drawing, ask one of our staff to drop your card in the bowl, bring a card by our office at 715 Cox Ave., or mail us a card at PO Box 1650.

RECORD/Melissa Schneider

Ryan Rubenstein, left, demonstrates how to use an infrared camera during a home inspection while Bob Rushing checks for termites with a high-tech acoustic sensor. Rubenstein and Rushing recently opened a HomeSafe Inspection franchise in Ocean Springs. The business partners offer the most technologically advanced home inspections available.

G



Daily News/DEBI HAUSSERMANN

Kenny Phillips, a home inspector with HomeSafe Inspection, examines a room with an infrared camera. The camera allows the inspector to see inside the walls and spot damages not visible to the naked eye.

Inspections Superman-style

By JONI WILLIAMS
Daily News Contributing Writer

It's a bird. It's a plane. No, it's Kenny Phillips, home inspector.

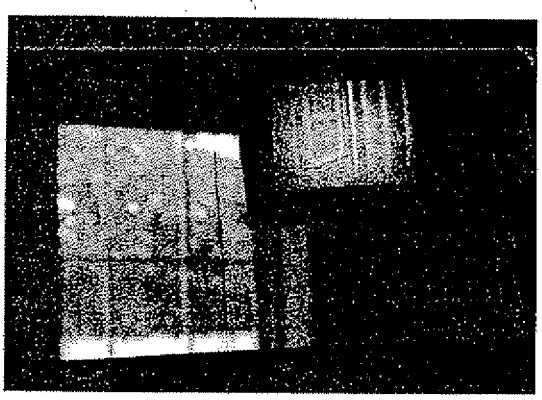
While he may not be faster than a speeding bullet or able to leap tall buildings in a single bound, Phillips is able to see and hear through walls.

"They said Superman had X-ray vision, but what he really had was infrared vision," said Rick Hynum of HomeSafe Inspections. "Our infrared cameras allow us to see through walls just like Superman."

Because of this visual advantage, HomeSafe inspectors such as Phillips are able to find an array of concealed defects that might otherwise go undetected. Common problems that can be uncovered include faulty wiring, moisture intrusion, leaky pipes and inadequate insulation.

Arguably the most notable attribute of an infrared-aided inspection is its ability to uncover termites, whose nests often cannot be located with the naked eye unless a wall is taken down to the studs.

"It tells us where to check with the acoustic probe," said Hynum, pointing out the probe that lets inspectors hear into the wall. "If there are termites in the wall, you can hear them. They make a very distinct sound; it's almost like knocking."



Daily News/DEBI HAUSSERMANN

Wall studs and a corner window are visible in this infrared image. Infrared imaging can detect structural damage, air leaks, water damage and termites without tearing into the walls.

If the camera produces a round or tubular image it signals a possible water source which in turn may indicate termites. An acoustic probe is then used to listen for noises produced by the pests.

The termite-talk is then rendered to special sound pattern recognition software used to determine the termite's species.

Hynum cautions the procedure isn't meant to replace traditional treatment procedures or even pre-purchase termite inspections.

Rather, he says, the detection process works to alert exterminators of their presence and aid in their elimination.

"We are able to detect them before they have done damage," Hynum noted.

Even though the process is proving beneficial for Floridians prone to termites, the inspectors also deliver a traditional comprehensive home inspection that reports on the overall functionality of a home.

"We are not trying to ignore traditional home inspection practices," said Phillips, who heads HomeSafe Inspection's Northwest Florida office. "We just have the ability to look into the wall."

Agent Robbie Fenn of RE/MAX Southern Realty likes the added protection offered by Phillips' sophisticated equipment.

"It takes the liability off of me," she said. "And (knowing of the defects) benefits both the buyer and the seller."

As with a traditional home inspection, Phillips checks the

Please see STYLE/G3

STYLE

From G1

plumbing, electrical, mechanical, roofing and exterior components of a home. However, home inspections always begin with a thorough infrared screening.

Because infrared essentially creates a visual image by measuring heat, Hynum said temperature variations may indicate wet spots within a wall. This in turn can alert inspectors to the potential for mold as well as the possibility of termites that transport water to their nesting sites.

"Termites and mold go hand-in-hand," he said.

Water intrusion can cause other headaches as well, particularly with EIFS siding. That's why Destin homebuyer Casey Graham opted for the infrared inspection when he recently contracted a home with the stucco-like siding.

"They let you look through the camera as they're doing the inspection," he said. "You can visually see where the water is rather than just see a moisture meter go off."

According to HomeSafe, subtle roofing and pipe leaks can be detected with infrared, as can faulty wirings and structural deficiencies. Rodents such as rats or squirrels that like to nest in walls or roofs are also revealed.

While ordinary gypsum walls allow for the procedures, other types, such as solid concrete, defy infrared's see-through ability.

Phillips said an inspection of an average-sized home lasts about three hours and costs between $250-$300. HomeSafe inspectors adhere to the standards and practices of the American Society of Home Inspectors and must pass a national test before completing a week-long infrared training session.

"Ideally you want an inspector with a construction background," said Phillips, who said his years in the industry fits the bill. "But even with all of the experience, you cannot detect the things that this camera can."

EXHIBIT 2 – DECLARATION OF PENG LEE

The Declaration of Peng Lee was received by the USPTO on 04/17/2006. The Examiner discussed the Declaration at Paragraph 6 of the 06/08/2006 Office Action.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPL. NO.:	10/708,571
APPLICANT(S):	Peng Lee
FILED:	March 11, 2004
TITLE:	NONDESTRUCTIVE RESIDENTIAL INSPECTION METHOD AND APPARATUS
TC/A.U.:	2859
EXAMINER:	JAGAN, Mirellys
DOCKET NO.:	026018.50271

DECLARATION UNDER 37 CFR § 1.132

I, Peng Lee, hereby declare that:

1. I, Peng Lee, am one of the inventors of the presently claimed technology for HomeSafe Inspection, Inc. which is the owner by assignment of all of the rights, title, and interests in this patent application.

2. In all of the attached thermal images, certain procedural steps were taken to improve resolution. These steps are set out in the pending independent claims 10 and 26:

turning on substantially all light switches in said residential building; and turning on substantially all exhaust blowers in said residential building.

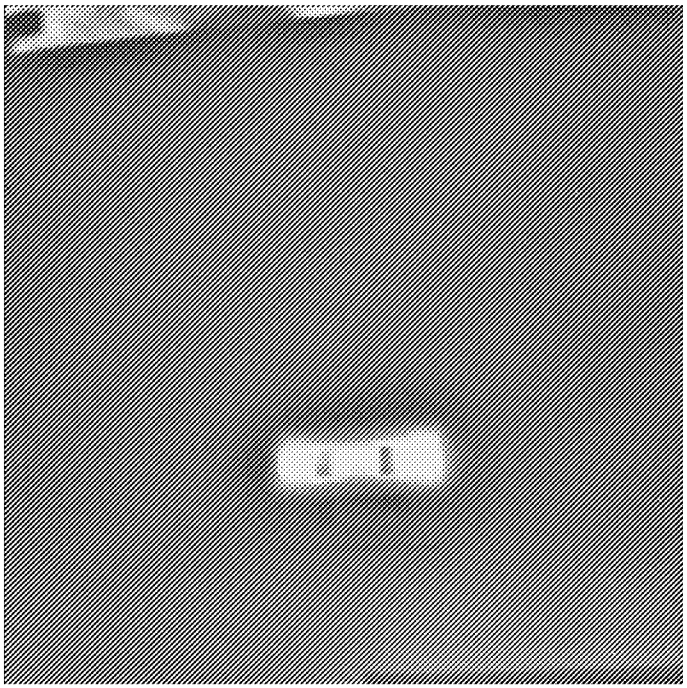
3. In Appendix A, the group of thermal images show surprisingly that, with respect to an electrical outlet both lack of insulation (i.e. dark or cold spots) and electric problems (i.e. white or hot spots) in the outlet can be observed at the same time if the procedural steps set out in the claims are adhered to during the inspection.

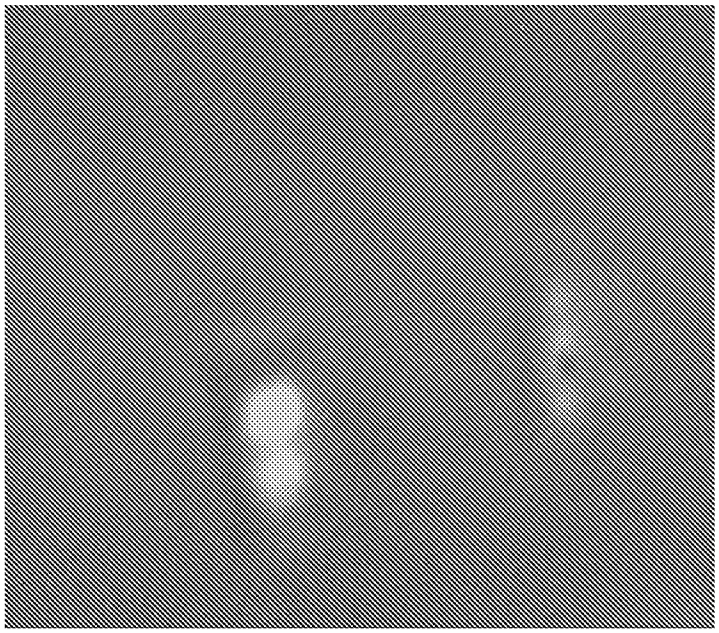
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, Section 1001 of Title 18 of the United States Code

and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

PENG LEE

DATE: 3-11-2006





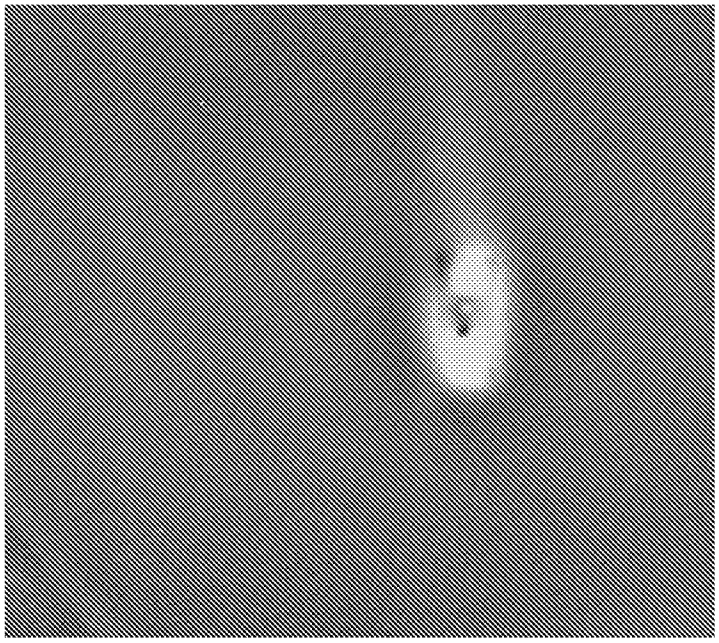


EXHIBIT 3 – DECLARATION OF BRUCE R. THOMAS

The Declaration of Bruce R. Thomas was received by the USPTO on 09/11/2006. The Examiner discussed the Declaration at Paragraph 5 of the 06/08/2006 Office Action.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPL. NO.:	10/708,571
APPLICANT(S):	Peng Lee
FILED:	March 11, 2004
TITLE:	NONDESTRUCTIVE RESIDENTIAL INSPECTION METHOD AND APPARATUS
TC/A.U.:	2859
EXAMINER:	JAGAN, Mirellys
DOCKET NO.:	026018.50271

DECLARATION UNDER 37 CFR § 1.132

I, Bruce R. Thomas, hereby declare that:

1. I, Bruce R. Thomas, am a home inspector. I have inspected more than 3,500 homes.

2. I am a nationally certified member of ASHI (American Society Home Inspection).

3. I have a degree in building construction with carpentry and construction experience.

4. I was formerly a full-time real estate agent.

5. I have read the attached patent application (App. Tab A) and now use these methods to inspect homes.

6. Based on the process described in the patent application (HomeSafe™ process), I create a temperature differential of greater than 10°F between the inside and the outside of the residential building and turn on substantially all light switches and substantially all exhaust blowers in the residential building, prior to obtaining temperature profiles.

7. Under these conditions I can then obtain temperature profiles of the exterior residential building components; obtain temperature profiles of the interior surface of a pitched roof; obtain temperature profiles of the interior residential building components; obtain temperature profiles of each electrical outlet in a residential building; assess each of the

temperature profiles to detect a thermal anomaly indicative of a problem with the residential building components; and provide a report listing problems to the homeowner.

8. I did not create a temperature differential of greater than 10°F between the inside and the outside of the residential building and turn on substantially all light switches and substantially all exhaust blowers in the residential building, prior to learning these techniques from HomeSafe™. The use of these techniques allow me to rapidly inspect a building because I obtain high contrast temperature profiles that can be easily interpreted.

9. There has been a long felt need in the industry for a process to rapidly, nondestructively inspect residential buildings. Particularly, as a past real estate agent, I can see a need for an infrared based home inspection technology that is sufficiently accurate to nondestructively detect a variety of defects such that the report can be used in real estate transactions.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Bruce R Thomas

BRUCE R. THOMAS

DATE: 8/23/06

Memphis 246094v.1

Electronic Version
Stylesheet Version v1.1.1

Description

[NONDESTRUCTIVE RESIDENTIAL INSPECTION METHOD AND APPARATUS]

Cross Reference to Related Applications

[0001] This Application claims the benefit of U.S. Provisional Application No. 60/453,856 filed March 12, 2003 under 35 U.S.C. Section 119(e) (hereby specifically incorporated by reference in its entirety)

Background of Invention

[0002] This invention relates to the field of nondestructive residential inspection.

[0003] Infrared thermography (thermal imaging scan) has been used in industrial electrical, mechanical, and boiler evaluations. In these applications, true temperature measurements are made of the structure being evaluated. True temperature evaluations require expensive equipment and time to take temperature measurements. Additionally, infrared imaging is used for (ASTM standard #C-1153) locating wet insulation in flat roof system. Most commercial,

industrial, and institutional roofs are flat roofs. However, there is no guideline or standard for pitched roofs inspection using thermal imaging. Infrared thermography has also been used to provide "energy audits" of homes (ISO 6781 and ASTM C 1090-90) and industrial electrical panel inspections. More specific, diagnostic applications of infrared technology for residential applications, however, require greater contrast between building components shown in the scanned images.

SUMMARY OF INVENTION

[0004] This invention provides a method to conduct a complete inspection of a residential building. A complete inspection includes the steps of: conducting an infrared scan of a residential building, conducting a visual home inspection and conducting an acoustic scan to detect wood destroying insects. The term infrared scan of a residential building includes all of the methods discussed *infra* in the section on infrared scanning methods.

[0005] This invention further relates to the following methods and devices for inspecting residential buildings. This method includes a thermal imaging (infrared) camera for looking into, examining and evaluating a building's structural and systemic components, such as walls, insulation,

electrical wiring, heating, air conditioning and plumbing. This method captures temperature profiles, which provide valuable information to evaluate and/or further investigate problems in the building. Additionally, this method includes procedures for creating favorable conditions for a thermal imaging scan to detect concealed and/or nonconcealed conditions of the building's components.

[0006] More specifically, this invention relates to a method to rapidly inspect residential building components for a designated entity such as a home owner, a realtor, an insurance company or any designated party. This method involves creating a temperature differential of greater than 10°F between the inside and the outside of the residential building. It also involves turning on substantially all light switches and substantially all exhaust blowers in the residential building and obtaining temperature profiles of the exterior residential building components selected from the group consisting of wall, eave and facia. It also involves obtaining temperature profiles of the interior surface of a pitched roof; obtaining temperature profiles of the interior residential building components; and obtaining temperature profiles of each electrical circuit in a residential building. Additionally, this invention relates to cre-

ating sufficient air flow in a basement to facilitate evaporation; and obtaining temperature profiles of a basement wall and assessing each of the temperature profiles to detect a thermal anomaly indicative of a problem with the residential building components; and reporting a problem to the designated entity.

[0007] It is a first objective of the invention to provide a nondestructive yet reliable method and apparatus for more accurate assessment of the condition of a residential building's components very quickly and to provide good record-keeping in regard to the building's condition.

[0008] It is a second objective of the invention to provide a procedure that creates a significant variation in temperature among the building's components in relation to the temperature outside the building. This process is carried out by introducing cold or heated air to the building, either through the building's own heating or cooling system or through external injection of cold or hot air to the building's interior.

[0009] These objectives are achieved, in accordance with the principles of a first preferred embodiment of the invention, by providing a method and apparatus for monitoring and recording the temperature profiles of a building's

components and structure.

[0010] Traditional home inspection primarily involves human visual inspection of a building's components. Since the human eye cannot see through walls and other solid objects, traditional visual inspection is limited to the surface level. Our preferred embodiment employs a thermal imaging sensor (infrared camera) that allows the inspector to view and inspect beyond the surface level through evaluation of the temperature profiles of building components due to the difference in thermal properties between building components.

[0011] The overall goal of the thermal imaging (infrared) home inspection system is to detect problems in buildings accurately and as early as possible. Early and accurate detection of a building's problems reduces further damage and provides valuable, more accurate and realistic information to all concerned parties, such as the building owner, the building seller, the real estate company, the loan company, the insurance company and, most important, the buyer.

[0012] Infrared detection has the advantage of covering a large area. It provides efficient screening and a convenient way of scanning the structure for potential problems in order

to alert the inspector to carry out a more specific inspection.

[0013] In accordance with another aspect of the preferred embodiment of the invention, the infrared scan is combined with a procedure to create a temperature differentiation between indoor and outdoor areas. This procedure provides the infrared camera with favorable conditions for scanning.

[0014] Because different seasons of the year generate different weather conditions, a building experiences large fluctuations of temperature, humidity and atmospheric pressure changes. At certain times of the year, such as spring and fall, the outdoor temperature can be very close or equal to the indoor temperature. This reduction of the difference between indoor and outdoor temperatures greatly reduces the thermal imaging (infrared) device's ability to "see" inside the building's components.

[0015] The preferred procedure of the invention creates a larger temperature contrast between the building's components, thus greatly increasing the effectiveness of the thermal imaging system. The bigger the temperature contrasts between the building's components, the better the temperature profiles will be.

[0016] In the other preferred embodiment these images of temperature variations can be recorded with a digital or analog image-recording device such as a camcorder.

[0017] Finally, according to yet another aspect of the preferred embodiment of the invention, recorded temperature profiles taken at each inspection site using the above-summarized methods and apparatus may be provided to a central operations unit for use in building a central database of information. The central operations unit may operate on a nationwide or even worldwide basis and serve as a facility of data communications, data acquisition, data analysis, continuous updating of temperature profiles, references and aggregation of inspection results. The accumulated data may be made available to entities interested in the building's condition, thereby providing an invaluable resource of building information. No such centralized resource is currently available.

Brief Description of Drawings

[0018] FIG. 1 is a schematic illustration of a nondestructive thermal imaging apparatus in accordance with the principles of a preferred embodiment of the invention.

[0019] FIG. 2 is a schematic illustration of a nondestructive thermal imaging apparatus in accordance with the principles

of a preferred embodiment of the invention.

[0020] FIG. 3 is a schematic illustration of an alternate embodiment of the apparatus.

[0021] FIG. 4A is a visual photograph of an EIFS wall.

[0022] FIG. 4B is a temperature profile of an EIFS wall.

[0023] FIG. 5A is a temperature profile of vinyl siding.

[0024] FIG. 5B is a temperature profile of vinyl siding.

[0025] FIG. 6 is a temperature profile of an eave.

[0026] FIG. 7 is a temperature profile of an EIFS wall.

[0027] FIG. 8 is a temperature profile of a wooden wall.

[0028] FIG. 9 is a temperature profile of a brick wall.

[0029] FIG. 10A is a temperature profile of the interior surface underside of a roof.

[0030] FIG. 10B is a temperature profile of the interior surface underside of a roof.

[0031] FIG. 10C is a temperature profile of the interior surface underside of a roof.

[0032] FIG. 11 is a temperature profile of electrical component.

[0033] FIG. 12 is a temperature profile of an electrical component.

[0034] FIG. 13A is a temperature profile of an electrical component.

[0035] FIG. 13B is a temperature profile of an electrical component.

[0036] FIG. 13C is a temperature profile of an electrical component.

[0037] FIG. 13D is a temperature profile of an electrical component.

[0038] FIG. 13E is a temperature profile of an electrical component.

[0039] FIG. 14A is a schematic drawing of a method to scan.

[0040] FIG. 14B is a schematic drawing of a method to scan.

[0041] FIG. 14C is a schematic drawing of a method to scan.

[0042] FIG. 15 is a temperature profile of a residential interior component.

[0043] FIG. 16 is a temperature profile of a residential interior component.

[0044] FIG. 17 is a temperature profile of a residential interior component.

[0045] FIG. 18 is a temperature profile of a residential interior component.

[0046] FIG. 19 is a temperature profile of a residential interior

component.

[0047] FIG. 20A is a temperature profile of a residential interior component.

[0048] FIG. 20B is a temperature profile of an air conditioning duct.

[0049] FIG. 21A is a temperature profile of a residential interior component.

[0050] FIG. 21B is a temperature profile of a residential interior component.

[0051] FIG. 21C is a temperature profile of a residential interior component.

[0052] FIG. 21D is a temperature profile of a residential interior component.

[0053] FIG.22 is a temperature profile of a residential interior component.

[0054] FIG. 23 is a temperature profile of a residential interior component.

[0055] FIG. 24 is a temperature profile of a residential interior component.

[0056] FIG. 25 is a temperature profile of a residential interior component.

[0057] FIG. 26 is a temperature profile of a residential interior component.

[0058] FIG. 27 is a temperature profile of a residential interior component.

[0059] FIG. 28 is a temperature profile of a residential interior component.

[0060] FIG. 29 is a temperature profile of a residential interior component.

[0061] FIG. 30 is a temperature profile of a residential interior component.

[0062] FIG. 31 is a temperature profile of a residential interior component.

Detailed Description

[0063] A home inspection is a thorough visual examination of a home's structural and systemic condition. A home inspection evaluates the physical condition of the home, identifies items that may need repair or replacement and identifies systems and components that are nearing the end of their service life.

[0064] Because a home purchase is one of the biggest investments a person will ever make, a home inspection is crucial in providing valuable information about the investment. It also assists in protecting against unknown and costly repairs that may not be obvious to the untrained eye. Items covered typically include the property's wall,

roof, structural components and major electrical, plumbing and operating systems.

[0065] Major areas of investigation in a home inspection include: I. Improper electrical wiring, such as open ground, hot and neutral reverse, inadequate overload protection, and hazardous wiring connections; II. Roof damage and leakage caused by old or damaged shingles and improper flashing; III. Poor overall maintenance as evidenced by such signs as cracked; makeshift wiring or plumbing; broken fixtures; IV. Structural issues, including damage to such structural components as foundation walls, floor joists, rafters and window and door headers; V. Improper surface grading and drainage problems, such as water penetration into the basement area or crawl spaces; VI. Flaws in the home's exterior, including doors, windows, door and wall surfaces, which may result in air or water penetration. Inadequate caulking or weather stripping are common culprits; VII. Ventilation problems which may result in excessive interior moisture, rotting and premature failure of both structural and nonstructural elements; and VIII. Depending on location, miscellaneous concerns such as the presence of mold, wood-destroying insects, able to see signs of rodents in the ceiling.

[0066] A home inspection to be of value to a home owner needs to be complete; however, a residential inspection to be affordable must be completed within a reasonable period of time. This invention provides a method to conduct a complete inspection of a residential building within a cost effective period of time, i.e., two hours for a residential building of 2,000 sq. ft. or less, and four hours for a residential building between 3,000 to 4,000 sq. ft. The complete inspection includes several parts. One part is an infrared scan of the residential building. This type of inspection is discussed in detail, infra. Another part of a complete or "traditional" inspection is a visual inspection. A visual inspection is defined by ASHI, NAHI, and NABIE protocols. Another part of the inspection is an acoustic scan of the residential building for wood destroying insects such as termites. The procedures to conduct termite acoustic detection are set out in U.S. Serial No. 10/680,377 filed October 7, 2003 (hereby specifically incorporated by reference in its entirety -- specifically, the software program at pages 28 through 42 which facilitates the acoustic detection of wood destroying insects). A report can be generated which summarizes all portions of the inspection.

[0067] *Infrared Scanning Methods and Apparatus* – Infrared scanning works because different parts of a building's components retain different temperatures due to the individual component type's thermal properties, such as heat capacity, heat transmission, heat retention and heat dissipation. The difference between indoor and outdoor temperatures creates a temperature gradient, causing the heat to transmit from high temperature areas to low temperature areas. Due to the different thermal properties of different residential building components, heat transmits and dissipates through these different residential building components at different rates.

[0068] Take a building's wall in the summertime, for example: When scanning the interior wall with an infrared camera, fiber grain insulation transmits much less heat than a 2 x 4 stud; the 2 x 4 stud thus has a higher temperature which can be easily registered by the infrared sensor (camera). Infrared detection also has the advantage of covering a larger area very quickly and provides the inspector with critical information about potential problem areas in order to guide the inspector to carry out more specific tests and inspections.

[0069] Because different seasons of the year generate different

weather conditions, a building experiences large fluctuations of temperature, humidity and atmospheric pressure changes. At certain times of the year, such as spring and fall, the outdoor temperature can be very close or equal to the indoor temperature. This reduction of the difference between indoor and outdoor temperatures greatly reduces the thermal imaging (infrared) device's ability to "see" inside the building's components.

[0070] The preferred procedure of the invention creates a larger temperature contrast between the building's components, thus greatly increasing the effectiveness of the thermal imaging system. The bigger the temperature contrasts between the building's components, the better the temperature profiles will be. The procedure involves activating the building's own heating or cooling system for a certain period of time prior to the inspection. The duration can be as brief as one minute to as lengthy as a few hours, depending on the size (capacity) of the heating/cooling system and the size and condition of the building. At a certain point of the heating or cooling process, the temperature contrast reaches a workable condition for the thermal imaging sensor. Therefore, the inspector will have to periodically check the conditions with the thermal imaging

camera. The decision to activate either the heating or cooling mode of the building's heating/cooling system will depend on the outdoor temperature. A preferred rule of thumb is to let the inspector make this judgment: If he feels it's cold outside (below 70°F), he will activate the heating system; if he feels that it's hot outside (above 70°F), he will activate the cooling system. In the event that the building is not equipped with a heating or cooling system, an external heating or cooling unit can be employed to achieve a similar effect. In this method, a temperature differential of greater than 10°F between the inside and the outside of the building is created. This can be achieved by running either the heating or air conditioning system until the desired temperature differential is obtained.

[0071] As schematically illustrated in Fig. 1, the preferred embodiment of the invention includes a thermal imaging (infrared) camera 1 for performing a scan of residential building components in order to locate potential problems in the building. An infrared camera is an apparatus that converts the spatial variations in infrared radiance from a surface into a two-dimensional image, in which variations in radiance are displayed as a range of colors or tones. In

this application, it is preferred that the image is displayed as tones, with dark shades representing cold and light shades representing hot infrared radiance. This is commonly called the gray scale. Gray scale work is best for home inspection because it is less confusing; however, color is also sufficient for home inspection.

[0072] The temperature profiles created by the thermal imaging camera can be assessed to detect a thermal anomaly indicative of a problem with the residential building components. In the preferred embodiment, each of the temperature profiles is assessed for an anomaly; however, in certain situations where time is limited or a specific problem is being addressed, at least one of the thermal anomalies are assessed for a problem.

[0073] A problem in a residential building component will appear as an anomaly in a temperature profile. An anomaly is any deviation from the normal characteristics of a specific type of residential building component. FIGS. 4 13, and 15 - 31 show a series of normal temperature profiles and temperature profile anomalies. A temperature profile anomaly is indicative of a problem with the residential building component. These building problems include but are not limited to the following: structure, insulation, moisture, elec-

trical hot spots, water leakage, unwanted pests such as termite, mice, and rats, and air duct leakage. The term residential building components include elements of a building, such as walls, ceilings, windows, plumbing fixtures, etc. The residential building component can be an exterior component, such as exterior wall (wood, bricks, stucco, EIFS or vinyl siding), eaves, fascias and interior surface of a pitched roof. Similarly, the residential building component can be the electrical system. Additionally, the residential building component can be an interior structure, such as insulation, wiring, air duct, and finished surfaces.

[0074] The corresponding video images of the potential building problems are recorded by digital video camera 2. A digital video camera 2 is a means to record a digital image. The thermal imaging camera 1 is connected to digital video camera 2 by cable 5. The video output of the infrared camera 1 is input to the video recording device. Thermal imaging camera 1 may be any of a number of commercially available infrared cameras conventionally used by structural engineers, police and the military. In order to improve the accuracy by which thermal imaging camera 1 detects potential problems, the thermal imaging camera 1

may further include target recognition software, such as matched filtering software which compares the frequency spectra of reference images, thereby reducing the level of skill required of the camera operator.

[0075] While the invention is not limited to a particular thermal imaging (infrared) camera 1, there are various thermal imaging systems that are sensitive enough and capable of evaluating residential building components. For example, Raytheon's Control IR2000B or 300D thermal imaging system, although not the most sensitive, has shown good consistency and accuracy. It is robust and, most importantly, relatively inexpensive. Those skilled in the art will appreciate that it is also possible to use other types of thermal imaging cameras 1 so long as they are sufficiently sensitive to detect temperature variations normally down to 0.12 degrees Celsius or lower (e.g., 0.08 degrees Celsius) and cover an approximate frequency range of the infrared spectrum emitted by residential building components. The infrared detector resolution is preferably 240x320 or higher; but can be 120x160 (with a good thermal window). It will, of course, be appreciated by those skilled in home inspection that the thermal imaging camera 1 and the digital video camera 2 may be combined

into a combination unit 6 as shown in FIG. 3. However, a combination unit 6 presently carries a much higher price tag, which makes the residential application much less attractive.

[0076] While one particularly preferred embodiment is the new arrangement specifically designed to securely position the device in front of the inspector for ease of operation, out of harm's way to protect the sensitive infrared camera, and to allow the inspector to have both hands free when needed to move an object. As shown in FIG. 1, a harness apparatus 3 allows both the thermal imaging camera 1 and the digital video camera 2 to be mounted in a balanced, safe and easy-to-use position for the inspector. As shown in FIG. 2, the harness apparatus 3 is designed to be securely mounted over the inspector's shoulders. The harness apparatus 3 allows the operator to operate with his hands with the aid of the handles 4 or without hands in the event that the hands need to be free to perform other functions, with add chest support (not shown) The harness apparatus 3 is configured to support at least one residential inspection device. The residential inspection device can include, for example, a thermal imaging camera, a thermal imaging camera, video recording device, a

means to transmit or record a digital video image, such as a LCD or a digital camera, a combination unit thermal imaging camera recording and a wireless communication apparatus.

[0077] More specifically, the harness apparatus 3 in the preferred embodiment has a first portion 7 for supporting at least part of a thermal imaging camera 1 and if desired at least part of the video recording device 2 such as a digital video camera. In this embodiment, the thermal imaging camera 1 and the video recording device 2 are attached to the first portion 7 of the harness 3. This first portion 7 is connected to a second portion 8. The first and second portions form an enclosure. The enclosure is of sufficient size to accommodate a human torso as shown in FIG. 2. The thermal imaging camera 1 in this embodiment is operably connected via a cable 5 to a video recording device 2.

[0078] The second portion 2 is generally "U shaped" with the leg portions of the "U" being sufficiently spaced apart to accommodate a human torso. The second portion 8 can function to support at least part of the thermal imaging camera 1 and at least part of the digital video camera 2. The second portion 8 is configured to receive the shoulder portions of a human. The term configured to receive the

shoulder portion of the human torso means that the second portion 8 rests on the shoulder so that the harness 3 is above the shoulders. In one embodiment, the residential inspection devices are attached to the second portion. The first portion 7 and second portion 8 are configured to support at least one residential inspection device in that they provide a flat, rigid platform for the residential inspection devices. The second portion 8 can include a plurality of handles 4 which project generally downwardly. The plurality of handles 4 may be of any shape to be gripped by the hand of the person wearing the harness apparatus 3. The second portion 8 can be formed of two parts to make a more rectangular enclosure (not shown).

[0079] In the alternate embodiment shown in FIG. 3, the harness apparatus 3 is a generally triangular shaped substantially one piece unit. In this embodiment, a combination unit thermal imaging camera recording device 6 is affixed to the first portion 7 of the harness apparatus 3. The harness apparatus 3 includes a portion 8 adopted to retain the shoulder portion of a human torso. A single handle 12 can be made one piece with the unit or attached to the harness apparatus 3.

[0080] The embodiment shown in FIGS. 1 and 2 can include a

means to transmit a digital image to a central receiving facility. This communication apparatus 13 can be affixed to harness apparatus 3. Various wireless communication apparatus are known to those skilled in the art, such as a wireless internet communication system.

[0081] *Exterior Residential Application* – The use of the infrared equipment for exterior inspection has proved beneficial in cases where the exterior clad is made of wood and wood product siding, EIFS, or vinyl siding. The thermal properties of these materials are such that the infrared camera can discern moisture infiltration, some structural anomalies, and the occasional insect infestation. The same can be said for inspection of eaves and fascias utilizing the infrared equipment.

[0082] There are some cautions that the user has to be aware of, however. First and foremost, if the infrared equipment is being used outdoors, the current weather conditions should be an obvious consideration. Precipitation of any kind will damage the electronics, the digital camera and the infrared camera.

[0083] Another consideration is the position of the sun. The thermal load provided by direct, or indirect, sunlight (also called solar load) is tremendous and cannot be compen-

sated for by the equipment. Therefore, successful use of the infrared sensor depends on the time of day and solar position. The user may have to delay or reschedule use of the infrared equipment on a particular part of the house that is currently in full sun. Solar loading can, however, provide opportunities for infrared investigations of exteriors that ordinarily would not be possible. Successful use of the equipment on exterior surfaces depends on access to a thermal window. The thermal window represents the optimum opportunity for the infrared camera to discern thermal differences within building components. The optimal time to catch the thermal window for exterior wall surfaces are after sunset and after sunrise.

[0084] More specifically, conditions for obtaining a good thermal window are: sunny day, little to no wind, and clear sky. During the summer time, a thermal window begins to open around an hour to a couple of hours after sunset and after sunrise when sun energy begins to heat up the wall surfaces. In the wintertime a thermal window may begin to open as early as a few minutes after sunset and right after sunrise, depending on where you are. The colder the location is, the faster the thermal window will open.

[0085] Thermal capacity is the physical property of a material's ability to store energy. The materials in a wall assembly have relatively low thermal capacitances when compared to water. Water requires a lot of energy to raise its temperature and likewise must release a lot of energy to cool down. Therefore, moisture in a finished exterior wall will appear as cold spot during the after sunrise thermal window period on the other hand it will appear as warm spot during the after sunset thermal window. This phenomenal provides us a very useful way of inspecting moisture within finished exterior wall such as various type of siding (steel, vinyl, etc..), stucco, Exterior Insulation Finish System(EIFS). However, it should be noted that a thermal window exists when there is a differential temperature between building components. This can occur if one of the components includes moisture or if one of the components is being differentially heated by the sun.

[0086] Thermal window for inspecting within either finished exterior wall, interior wall or exterior roof overhang (eaves) can also be obtained when moisture allowed to evaporate. In order for water molecule to evaporate it must absorb heat energy from its surrounding as a result the moisture spot appear as cold spot. When the thermal window

opens, the operator will be able to see more and more visual definition of the thermal differences within building components and its components. This means that as the window opens, the internal components of a wall's structure will become more and more pronounced as displayed on the video screen of the equipment, leading to better resolution and increased accuracy of the inspection.

[0087] More specifically, this process relates to an inspection of an exterior residential building component. The exterior residential building component is selected from the group consisting of: wall, fascia and eave. The process of obtaining a temperature profile of an outside residential component implies that a thermal window exists, in that, a useful temperature profile could not be obtained without thermal differences between components. The next step involves obtaining a temperature profile of the exterior residential building components. Then, a temperature profile is recorded on a digital recording device. The digital recording is reviewed to detect any thermal anomalies. Now referring to FIG. 4A, an EFIS exterior wall is shown with a regular video photograph. In FIG 4B, a temperature profile, taken in the morning after sunrise when the thermal window has just began to open shows a warm spot 1

which is indicative of moisture within an EFIS wall.

[0088] In FIG. 5A and 5B, temperature profiles, taken when moisture is allowed to evaporate shows anomalies as dark spots 2 and 3 under the vinyl siding. This moisture is not visible to the human eye. These anomalies 2 and 3 are indicative of the presence of moisture under the vinyl siding.

[0089] Now referring to FIG. 6, a temperature profile, taken in the morning after sunrise of an eave shows a number of anomalies. Anomaly 4 and 5 are indicative of current structural deformations due to past infiltration of water (dried) and anomaly 6 is indicative of the presence of moisture.

[0090] FIG. 7 shows a temperature profile taken in the morning of a dry EIFS wall showing no thermal anomalies.

[0091] FIGS. 8 and 9 show temperature profile taken at noon. In FIG. 8, no thermal anomalies are present, while in FIG. 9, a thermal anomaly 8 shows a cracked brick wall. This temperature profile shows as a thermal anomaly because moisture is in the crack in the wall.

[0092] *Roofs (Pitched Roof) Applications* - In the heat of the day, the thermal load on a roof can be quite striking to view through an infrared detector. Anomalies show up as dark

shadows against a bright background. More specifically, referring to FIGS. 10A and 10B, thermal anomalies 9 and 10 are shown as dark spots. This type of thermal anomaly is indicative of water damage to a roof. These types of thermal anomalies are present for two to three days after rain. This period is considered the thermal window for this application. In the present method, a pitched roof is defined as a roof having a slope ranging greater than a rise of 1 by 12 inches.

[0093] A pitched roof is inspected by obtaining a temperature profile of the interior surface of the pitched roof from inside of the attic within three days of rain. This method using an infrared camera coupled to a digital camera can provide information on active water leaks prior to the leaks being visible. Water damage to a roof as seen from the interior of the attic space is revealed as dark shadows against the normally bright roof decking. When conducting this method, additional confirmation can be obtained by observing: (a)standing water below the stain or interior staining or water damage on finished surfaces; or (b) presence of moisture confirmed from results of moisture meter test; or (c) visible damage to the decking such as: presence of a dark stain coupled with positive moisture

meter reading; or presence of visible active growths of mold or mildew; or decking delamination; or decking discoloration; or combinations of the above.

[0094] This invention can be applied to pitched roofs to inspect the condition of a residential roof. More specifically, in FIG. 10C the source of a leak can be traced by assessing the thermal anomaly 11. The leak can be followed from left to right to find the leak shown as the dark spot. Additionally, this method can also be used to detect structural deformation. The thermal anomaly shown as the white irregular spot 12 is indicative of a puncture in the roof decking material with the shingles covering over the puncture. This method can also be used to detect structural damage such as cracks. The temperature profile is recorded on a digital recording device.

[0095] *Electrical Applications* – Many problems in the electrical systems are the result of abnormal heating associated with high resistance or excessive current flow. Thermal imaging scan (Infrared thermography) allows us to see these invisible thermal patterns before damage occurs. A thermal imaging scan allows an inspector to quickly locate the suspicious electrical hot spots from among the hundreds and thousands of potential problems. The primary benefit

of inspecting residential building electrical system is to increase safety.

[0096] When electricity (electrical current) flows through a circuit, part of the electrical current is converted into heat energy. This is due to the normal electrical resistance in the circuit. High resistance has been used to produce heat or light to make our life more comfortable. However, in many instances, heat is an unwanted by-product that results in energy lost, costly damage, and hazarded condition. For example, when resistance is unusually high due to an over fuse under size conductor, loose connection, rusted connection, defective switch, the circuit may become hot. Electrical components can become hot enough to melt the electrical insulation and result in a house fire.

[0097] There are two major categories of electrical hot spots: contact surface over heat and overload. 1. Contact surface over heat - This type of problem occurred when electrical current flow through a single point of contact with high resistance. They usually associated with rusted or warned out switch contact. The same problem can also occurred to electrical connector. 2. Overload - This type of problem occurred when high amount of current flow through a circuit. They usually associated with over fuse under size

conductors.

[0098] Infrared detection provides another level of inspection for the electrical service throughout the house. This method to detect a potential overload of an electrical circuit in a residential building includes turning on substantially all light switches and exhaust blowers in a residential building. Next, a temperature profile is obtained of each electrical outlet in the residential building. The temperature profile is assessed for a thermal anomaly. If a thermal anomaly is detected, the next step can be to determine compliance with safety electrical guidelines.

[0099] *Safety Electrical Guidelines:* (1) make sure no over fuse (over breaker); (2) make sure proper grounding; (3) make sure no hot neutral reverse; (4) make sure no open ground; (5) Make sure all other electrical safety installation procedures are followed (such as aluminum wire, and GFCI.

[0100] The purpose of turning on substantially all of the light switches and substantially all of the exhaust blowers is to allow current to flow through the normal electrical loads while the inspector performs the exterior inspection. If a few light switches or blowers are missed, this still constitutes "substantially all". The order of which is turned on first is not important between the light switches and the

exhaust blowers. During the time the inspector is inspecting the exterior portion of the house, the electrical system in the house has the opportunity to heat up under normal load. If an electrical circuit is drawing substantial amount of current that the circuit can't support, or in the case of faulty connections or faulty switches, the circuit will heat up and can provide a thermal signature indicating a potential problem with that particular circuit.

[0101] GFCI outlets and dimmer switch controls will always show a light heat signature in excess of surrounding materials because the GFCI outlet has an active circuit in operation at all times to test for electrical leakage. The dimmer switches are rheostats that adjust current flow to things like chandeliers, fans, etc. Since the current is adjustable, under maximum load the dimmer switch will also develop a heat signature in excess of that of the surrounding materials. Do not construe these normal heat signatures to mean that an inspector should not evaluate each dimmer switch or GFCI outlet. On the contrary, the inspector should take time to determine if the temperature differential is unusually high for each of the above. If the dimmer switch or switch plate cover is hot to the touch or 30 degrees F. higher than the surrounding wall temperature,

further investigation is warranted. The same is true of a GFCI that is unusually warm or hot to the touch.

[0102] Referring to FIGS. 11, 12, 13A and 13B, various temperature profiles of electrical components are shown. These temperature profiles are made as part of a process to detect a potential problem with an electrical circuit of a residential building. In this method, the first step is to turn on substantially all of the light switches in the residential building. Then, a temperature profile, such as those shown in FIGS. 11, 12, 13A and 13B is obtained. Each of the temperature profiles is assessed for an anomaly. For example, FIG. 11 shows an on/off switch 13 and a GFCI outlet 14 that are normal. FIG. 12 is a temperature profile of a dimmer switcher that shows an anomaly 15 indicative of a very hot dimmer switch. Similarly, FIGS. 13A and 13B show thermal anomalies 16-18 indicative of heavily loaded electrical circuits. FIGS. 13C-E show a thermal anomaly indicative of a hot electrical wire. When a thermal anomaly is detected, the next step, in the preferred embodiment, is to direct the designated entity to consult with a licensed electrician.

[0103] *Interior Residential Applications* - The interior building components of a residence can be thermally scanned. The in-

terior building component includes: wall insulation, plumbing, structural members and air ducts.

[0104] The inspector should turn on the heating/air conditioning by setting the interior thermostat(s) to 10° F. above or below the ambient exterior temperature shortly after arrival on site. When outdoor temperature is above 70°F, turn on the air conditioner to 10°F lower. When outdoor temperature is less than 70°F, turn on the heat to 10°F higher. This provides two of the three major requirements to obtain a suitable thermal gradient within a house: 1) increasing temperature differential between finished surfaces and interior ambient air temperature, and 2) interior air movement throughout the living spaces of the home. The temperature differential provides the gradient. The moving air enhances the gradient and sharpens the contrast between hidden moisture within structures and substrates and other areas within the structures or substrate, permitting the thermal camera to visually illustrate those thermal differences.

[0105] Referring to FIGS. 14A, 14B and 14C, a method to scan an interior residential building component is disclosed. In the first step of this scanning method, an operator using the thermal imaging camera 1, digital recording device 2 and

harness apparatus 3 shown in FIG. 1 scans from afar as shown in FIG. 14A. Next, the operator scans from mid-range pointing the imaging camera 1 from two equidistant points in a room as shown in FIG. 14B. In the next step, as shown in FIG. 14C, a scan from close range is accomplished by scanning a plurality of points within a smaller arc. Different inspectors may have a different way of scanning the interior of the building; however, any method adopted should be systematic to insure completeness. The combination of the use of the harness apparatus 3, the use of a systematic method to scan and the use of the methods to improve image contrast result in a rapid method to nondestructively inspect a residence.

[0106] When assessing the temperature profile, it is important for the inspector to confirm the dark spots are not due to:(1)improper setting of the infrared camera;(2)cold air from HVAC or cold outside air;(3)water pipes; (4)knots of wood; and(5)improper installation of insulation.

[0107] *(1) Insulation* – Infrared wall inspection can some time be confusing due to various reasons. The following discussion provides a basis to review thermal scans conducted in different seasons.

[0108] Now referring to FIG. 15, 2x4 studs and ceiling rafters ap-

pear as cold in a well-insulated wall during the winter season. This is due to the fact that insulation is a relatively poor heat conductor as compared to 2x4 wood stud ceiling rafters, as a result, 2x4 wood stud ceiling rafters lose relatively more heat than the insulation (from indoor to outdoor).

[0109] Now referring to FIGS. 16 and 17, 2x4 studs 20 and 21 appear as warm in uninsulated or very poorly insulated wall (left half of the wall) during the winter season. This is due to the fact that 2x4 wood stud now is a relatively better insulator as compare to uninsulated air space, as a result the 2x4 stud looses relatively less heat than the uninsulated air space (from the indoor to the outdoor). The right portion 19 and 22 appears to be insulated from this temperature profile.

[0110] Now referring to FIG. 18, 2x4 studs appear as warm in a well-insulated wall during the summer season. This is due to the fact that 2x4 wood stud is a relatively good heat conductor as compare to insulation between studs; as a result 2x4 studs conducts more out door heat then the insulated wall section.

[0111] Now referring to FIG. 19, 2x4 studs appear as cold in uninsulated or very poorly insulated wall during the sum-

mer season. This is due to the fact that the 2x4 wood studs now is a relatively better insulator as compare to uninsulated or poorly insulated air space, as a result 2x4 now conducts relatively less outdoor heat than the uninsulated or very poorly insulated wall section. The wall and ceiling of a residential building can be inspected to determine if they are uninsulated using this method. FIGS. 16, 17 and 19, show temperature profiles indicative of uninsulated interior building components.

[0112] *(2) Plumbing* – Hidden plumbing leaks can pinpoint within finished surfaces utilizing the thermal camera in cases where visual inspection was not possible. In FIG. 20A, a temperature profile is obtained for plumbing fixtures after the thermal window is created. The term plumbing fixture can include the plumbing fixture itself or associated piping. The temperature profile is recorded on a digital recording device and reviewed for a thermal anomaly. The temperature profile shown in FIG. 20A shows anomalies 23 and 24, which are indicative of a moisture leak behind the wall. FIG. 20B shows an air conditioning duct with a darker portion 25 indicative of cold air. The temperature profile of FIG. 20B is a normal profile for an air conditioning duct.

[0113] *(3) Condensation* – Poorly managed moisture in a building can cause considerable damage that is often concealed for some time. Moisture in vapor form in the air causes no harm to building. However, when this moisture condenses to liquid form at the wrong place, damage can occur. The tricky part is, this often happens in areas that are difficult or impossible to see (within wall cavity) or difficult to determine the cause behind the problem. In the event of water leakage in a building, as the water begins to evaporate it produces a colder area, which can also be easily registered by the infrared sensor (camera).

[0114] In the wintertime the air in an average house at 70°F and 40% relative humidity will be saturated and will condense to water droplets when the temperature drops to 45°F. It is not too difficult to understand how indoor air leaking into a wall or attic space will cool quickly. The outside of your walls and underside of the roof in your attic space is much closer to the outdoor temperature. When this bundle of warm moist indoor air leaks out through the wall or ceiling, it will cool and condense in the wall or ceiling/roof.

[0115] Condensation can also occur on interior ceiling surface as shown in FIG. 21A and 21B. The temperature profile

shown in figure 21A was taken 4 feet away from the ceiling. The anomaly 26 is indicative of moisture on the ceiling. The temperature profile 21B was taken 15 feet away from the same ceiling shown in Fig. 21A. The anomaly 27 is indicative of moisture in the ceiling.

[0116] *(4) Moisture in Air Duct* – Additionally, Figures 21C and 21D show anomalies 28 30, which are indicative of moisture in an air duct. This happens most often when there is no insulation in that particular section of the ceiling due to poor workmanship or due to rodent activities plus the occupant of the house has the lifestyle of generating high level of moisture with inadequate ventilation during the winter season. The uninsulated ceiling is closer to the cold outdoor temperature. When the high level moisture indoor air come in contact with the cold interior ceiling surface (the hotter the air the higher it rises and more moisture it can hold), it will cool and condense. This type of condensation problems were often mistaken as roof leaks. This happens when there is insufficient insulation around the air duct and poor workmanship or aging insulation. Condensation accumulates in cold air (in summer) eventually dripping into the ceiling under the duct.

[0117] *(5) Mold* – Condensation in building can cause mold. Build-

ing materials that remain wet for between 24 to 48 hours have the potential for mold developing and developing quickly. Molds thrive on organic material and eventually eat away at the material. Cellulose material such as ceiling tile, dry wall, insulation, books, carpeting, upholstered furniture, curtains, food and etc. Remediation of mold: The most important thing is to find the source of causing the mold to grow, which is the moisture. A good mold investigator focuses on locating moisture not microbiology or sampling. Condensation, construction techniques, and water intrusion lie at the heart of a proper mold investigation. Mold issues begin and end with moisture issues - Caoimhin P. Connell (Senior Industrial Hygienist for Colorado industrial hygiene and toxicological consulting firm). The method for inspection of interior residential components can be applied to locate the source of moisture. The source of the moisture can be correlated with mold growth.

[0118] There is a limit to how much moisture can be stored. Wood is able to safely store up to 20 % moisture by weight. Moisture levels above this can cause rot, mold and mildew. The preset method can be used to locate moisture and correlate this moisture with mold growth.

[0119] *(6) Small Animals* – As for small animals, such as mice, rats, squirrels, and etc. when they infest a house attic or wall space, they tend to burrow through insulation, creating air gaps in the normally evenly distributed insulation and thereby changing the thermal properties of the insulation, leaving visual evidence of tunnels and nests that would normally be invisible to even the trained eye. FIGS. 22 and 23 are thermal profiles of an interior component of a residential building. A review of a digital recording of this thermal profile shows an anomaly that is interpreted as tunnels in insulation in the ceiling (FIG. 22) a tunnel in the insulation in the walls (FIG. 23).

[0120] *(7) Structural Misalignment or Damage* – In the case of less than perfect construction techniques, the trained observer can spot missing, mis-aligned or damaged internal structural members such as studs, headers, trimmers and the like. In some cases, those damaged or missing members may contribute to otherwise unaccounted for interior damage that would normally point to foundation troubles, but which are, in fact, framing problems. FIGS. 24 and 25 are temperature profiles of interior components of a residential building. In Figure 24, the thermal anomaly 31 is indicative of a structural misalignment. In Figure 25, the

thermal anomaly 32 is indicative of a structural misalignment. A review of the digital recording of the thermal profile shows an anomaly this is indicative of structure misalignment.

[0121] *(8) Wood Destroying Insect* – Pests such as termites and even mouse and rat infestations have been recorded because of the telltale thermal discrepancies their respective environments provide. In the case of native termite species, these destructive pests require moisture in order to survive at high humidity levels. The thermal imaging system provides an additional tool for discovering the presence of termites and increases the detection of an active colony from about 30% (traditional inspection method) to at least 60%. This means that while the sensor system cannot detect 100% of all termite infestations, it can measurably double the chances of finding active colonies that have not been discovered through traditional inspection. FIGS. 26 and 27 are thermal profiles indicative of suspected termite infestation. More specifically, Figure 26 shows to thermal anomalies 33 and 34, indicative of suspicious wood destroying insect infestation. Similarly, Figure 27 shows an anomaly 35 indicative of wood destroying insect infestation. The presence of wood destroying insects can

be confirmed by an acoustic scan. The protocol for an acoustic scan is set out in U.S. Serial No. 10/680, 377 filed October 7, 2003.

[0122] *(9) Air Duct Leakage* – FIGS. 28 and 29 show a temperature profile indicative of air duct leakage. In these temperature profiles, the anomalies 36 – 38 are indicative of air leaking out of an air duct. The black is cold air leakage in the summer (in the winter it would be opposite).

[0123] *(10) Inspection of basement wall (water leaks through cracks, pipes, etc .)* – The application of the present thermal imaging techniques provides the ability to distinguish areas of relative temperature difference. This means that cool areas appear dark relative to warmer areas, which appear lighter. Relative temperature can be seen under these conditions. The first is different thermal characteristics of the building components, the second is actual differences in temperature, and the third is the ability of heat to be removed from the substrate by evaporation. The mere presence of moisture within or exterior to a building component does not guarantee that the thermal camera will show that moisture is present. There has to be a way for evaporation to permit heat loss. Without the ability to evaporate, water will take on the temperature of the sub-

strate, and the equipment will be blind to the presence of the moisture. It should be recalled in order for the camera to distinguish relative differences in temperature, there has to exist a temperature difference of 0.08°C or greater between residential building components.

[0124] Thus, to inspect a basement, if it is necessary, to create air flow to the basement area by: (a) Open heating or cooling air outlet if they are closed (wait for at least 30 Minutes before infrared scan);(b) Open all basement doors or windows (wait for at least 30 minutes before Infrared scan); and(c) Create artificial air flow by using portable force air heater (wait for at least 30 minutes before infrared scan).

[0125] FIGS. 30 and 31 are temperature profiles indicative of moisture penetrating through cracks in a basement wall. More specifically, in Figures 30 and 31, anomalies 39 and 40 are indicative of moisture on a basement wall.

[0126] The temperature profiles database library is made of a compilation of numerous temperature profiles in different settings, areas and conditions over a period of years. In this regard, the system may be used as an experimental set-up to capture recordings of temperature profiles that can be used as reference patterns for comparison with fu-

ture captured temperature profile patterns. The temperature profiles database library can also be used as a valuable training tool for training future inspectors. This invention also provides a method for facilitating a computerized method for inspection of a residential building. This method involves maintaining a database of temperature profiles for residential building components at a computerized, centralized facility. The temperature profiles can be input to the computer via a wireless transmission means such as wireless internet connection or by a nonwireless transmission means, such as a disk, a cable and infrared transmission.

[0127] An application database management program, such as SAP or Oracle, can be used to set up fields, such as, type of anomaly, normal residential building component, residential building component with an anomaly, and a specific designated residential building. The fields are used to facilitate scanning the database for a selected temperature profile. Thus, if one is interested in, for example, a specific residential building, all temperature profiles relating to a specific house are selected. For example, a specific residential structure can be inspected on a periodic basis, and the temperature profiles can be maintained in a field

in the database. These inspections can occur on different days such as three times a year. A printer driver on the hard drive of the computer is used to control a printing device to print a report showing selected temperature profiles of residential building components.

[0128] Although the present invention has been described and illustrated with respect to preferred embodiments and a preferred use thereof, it is not to be so limited since modifications and changes can be made therein which are within the full scope of the invention.

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Claims

[c1] A method for a complete residential building inspection comprising the steps of:
conducting an infrared scan of said residential building;
conducting a visual inspection of said residential building; and
conducting an acoustic scan for wood destroying insects of said residential building.

[c2] The method of claim 1 wherein said complete residential inspection is completed in less than two hours for a residential building of up to 2,000 sq. ft.

[c3] The method of claim 1 wherein said complete residential inspection is completed in less than four hours for a residential building of up to 4,000 sq. ft.

[c4] A method to nondestructively inspect residential building components for a designated entity, the residential building having an inside and an outside, comprising the steps of:
creating a temperature differential of greater than 10° F between the inside and the outside of said residential building;

turning on substantially all light switches and substantially all exhaust blowers in said residential building;
obtaining temperature profiles of the exterior residential building components selected from the group consisting of wall, eave, and facia;
assessing at least one of said temperature profiles to detect a thermal anomaly indicative of a problem with said residential building components; and
reporting said problem to said designated entity.

[c5] The method of claim 4 further comprising: obtaining temperature profiles of the interior surface of a pitched roof, prior to assessing at least one of said temperature profiles.

[c6] The method of claim 4 further comprising: obtaining temperature profiles of interior residential building components, prior to assessing at least one of said temperature profiles.

[c7] The method of claim 4 further comprising: creating sufficient air flow in a basement to facilitate evaporation and obtaining temperature profiles of a basement wall, prior to assessing at least one of said temperature profiles.

[c8] The method of claim 4 further comprising: obtaining

temperature profiles of each electrical circuit in a residential building, prior to assessing at least one of said temperature profiles.

[c9] The method of claim 4 wherein said temperature profiles are captured by a thermal imaging camera affixed to the harness apparatus of claim 31.

[c10] A method to rapidly inspect residential building components for a designated entity comprising:
creating a temperature differential of greater than 10°F between the inside and the outside of said residential building;
turning on substantially all light switches and substantially all exhaust blowers in said residential building;
obtaining temperature profiles of the exterior residential building components selected from the group consisting of wall, eave and facia;
obtaining temperature profiles of the interior surface of a pitched roof;
obtaining temperature profiles of the interior residential building components;
obtaining temperature profiles of each electrical circuit in a residential building;
assessing each of said temperature profiles to detect a thermal anomaly indicative of a problem with said residential building components; and

reporting a problem to said designated entity;
wherein the time between creating a temperature differential of greater than 10° F between the inside and the outside of said residential building.

[c11] The method of claim 10 further comprising: creating sufficient air flow in a basement to facilitate evaporation; and obtaining temperature profiles of a basement wall prior to assessing each of said temperature profiles.

[c12] A method to inspect interior building components of a residential building having an inside and an outside comprising:
creating a temperature differential of greater than 10°F between the inside and the outside of said residential building;
obtaining temperature profiles of said interior building components; and
assessing each of said temperature profiles for a thermal anomaly.

[c13] The method of claim 12 wherein said interior building components are selected from the group consisting of wall and ceiling and said thermal anomaly is indicative of an uninsulated interior building component.

[c14] The method of claim 12 wherein one of said interior

building components is a plumbing fixture and said thermal anomaly is indicative of moisture.

[c15] The method of claim 12 wherein one of said interior building components is an air duct and said thermal anomaly is indicative of moisture in said air duct.

[c16] The method of claim 12 wherein said interior building components is selected from the group consisting of a wall and a ceiling and said thermal anomaly is indicative of damage to insulation by small animals.

[c17] The method of claim 12 wherein said interior building components are selected from the group consisting of a wall and a ceiling and said thermal anomaly is indicative of misaligned structural member.

[c18] The method of claim 12 wherein said interior building components are selected from the group consisting of a wall and a ceiling and said thermal anomaly is indicative of wood destroying insects.

[c19] The method of claim 12 wherein one of said interior building components is an air duct and said thermal anomaly is indicative of air leaking out of said air duct.

[c20] The method of claim 12 wherein one of said interior building components is a ceiling and said thermal

anomaly is indicative of condensation.

[c21] The method of claim 12 wherein said temperature profiles are recorded on a digital recording device.

[c22] A method to locate the source of mold growth in a residential building having an inside and an outside comprise the steps of:
creating a temperature differential of greater than 10° F between the inside of a residential building;
obtaining temperature profiles of interior residential building components;
reviewing said temperature profiles for a thermal anomaly indicative of moisture; and
correlating moisture in said interior residential building with mold growth.

[c23] The method of claim 22 wherein said temperature profiles are recorded on a digital recording device.

[c24] A method to inspect a basement wall for cracks comprising:
creating sufficient air flow in the basement to facilitate evaporation;
obtaining temperature profiles of said basement wall; and
assessing each of said temperature profiles for a thermal

anomaly indicative of cracks in said basement wall.

[c25] The method of claim 24 wherein said temperature profiles are recorded on a digital recording device.

[c26] A method to detect a potential problem with an electrical circuit in a residential building comprising:
turning on substantially all light switches in said residential building;
turning on substantially all exhaust blowers in said residential building;
obtaining temperature profiles of substantially all electrical outlets in said residential building; and
assessing each of said temperature profiles for an anomaly indicative of an electrical problem.

[c27] The method of claim 26 wherein said electrical problem is an overload of an electrical circuit.

[c28] The method of claim 26 wherein said electrical problem is contact surface over heat.

[c29] The method of claim 26 wherein said electrical problem is hot electrical wire within a wall.

[c30] The method of claim 26 wherein said temperature profiles are recorded on a digital recording device.

[c31] A harness apparatus for providing a stable hands free

platform for at least one residential inspection device comprising:
a first portion configured to support at least part of at least one residential inspection device; and
a second portion configured to receive the shoulder portions of a human torso, wherein said first portion and second portion form an enclosure of sufficient size to accommodate a human torso;
wherein said first portion and second portion are configured to form a platform for at least one residential inspection device.

[c32] The harness apparatus of claim 31 wherein said at least one residential inspection device is a thermal imaging camera.

[c33] The harness apparatus of claim 31 wherein said at least one residential inspection device is a means to transmit a digital image.

[c34] The harness apparatus of claim 31 wherein said at least one residential inspection device is a video recording device.

[c35] The harness apparatus of claim 31 wherein said at least one residential inspection device is a thermal imaging camera and a video recording device and said thermal

imaging camera is operably connected to said video recording device.

[c36] The harness apparatus of claim 31 wherein said at least one residential inspection device is attached to said first portion.

[c37] The harness apparatus of claim 31 wherein said at least one residential inspection device is attached to said second portion.

[c38] The harness apparatus of claim 31 wherein said first portion includes a handle projecting generally downwardly.

[c39] The harness apparatus of claim 31 wherein said second portion includes a plurality of handles projecting generally downwardly.

[c40] The harness apparatus of claim 31 wherein said second portion is configured to support at least a part of a thermal imaging camera.

[c41] The harness apparatus of claim 31 wherein said second portion is configured to support at least part of a video recording device.

[c42] A method to inspect an exterior component of a residential building wherein said exterior residential building

component is selected from the group consisting of wall, eave and facia, comprising the steps of:
obtaining temperature profiles of the exterior residential building components; and
assessing each of said temperature profiles for a thermal anomaly.

[c43] The method of claim 42 wherein said thermal anomaly is indicative of moisture.

[c44] The method of claim 42 wherein said thermal anomaly is indicative of structural deformation.

[c45] The method of claim 42 wherein said thermal anomaly is indicative of insect infestation.

[c46] The method of claim 42 wherein said temperature profiles are obtained after sunrise.

[c47] The method of claim 42 wherein said temperature profiles are obtained after sunset.

[c48] The method of claim 42 wherein said thermal anomaly is indicative of a structural deformation due to the past presence of moisture.

[c49] The method of claim 42 wherein said temperature profiles are recorded on a digital recording device.

[c50] A method to inspect the condition of a pitched roof of a residential building comprising:
obtaining temperature profiles of the interior surface of said pitched roof within three days of rain; and
assessing each of said temperature profiles for a thermal anomaly.

[c51] The method of claim 50 wherein said thermal anomaly is indicative of moisture.

[c52] The method of claim 50 wherein said thermal anomaly is indicative of structural deformation.

[c53] The method of claim 50 wherein said temperature profiles are recorded on a digital recording device.

[c54] A computerized method for facilitating inspection of a residential building comprising the steps of:
maintaining a database of temperature profiles for residential building components on a computer;
scanning said database for selected temperature profiles of residential building components; and
controlling a printing device to print a report showing selected temperature profiles of residential building components.

[c55] The computerized method of claim 54 wherein said temperature profiles are input to said computer via wireless

transmission means.

[c56] The computerized method of claim 54 wherein said temperature profiles are input to said computer via nonwireless transmission means.

[c57] The computerized method of claim 54 wherein said selected temperature profiles are for a specific residential building.

[c58] The methods of claim 54 wherein said selected temperature profiles are taken on different days.

[c59] The computerized method of claim 47 wherein said temperature profiles are input to said computer via nonwireless transmission means.

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[NONDESTRUCTIVE RESIDENTIAL INSPECTION METHOD AND APPARATUS]

Abstract

This invention provides an apparatus for nondestructive residential inspection and various methods for using a thermal imaging apparatus coupled to inspect exterior residential components, interior residential components, a pitched roof and basement of a residential building and the electrical system of a residential building.

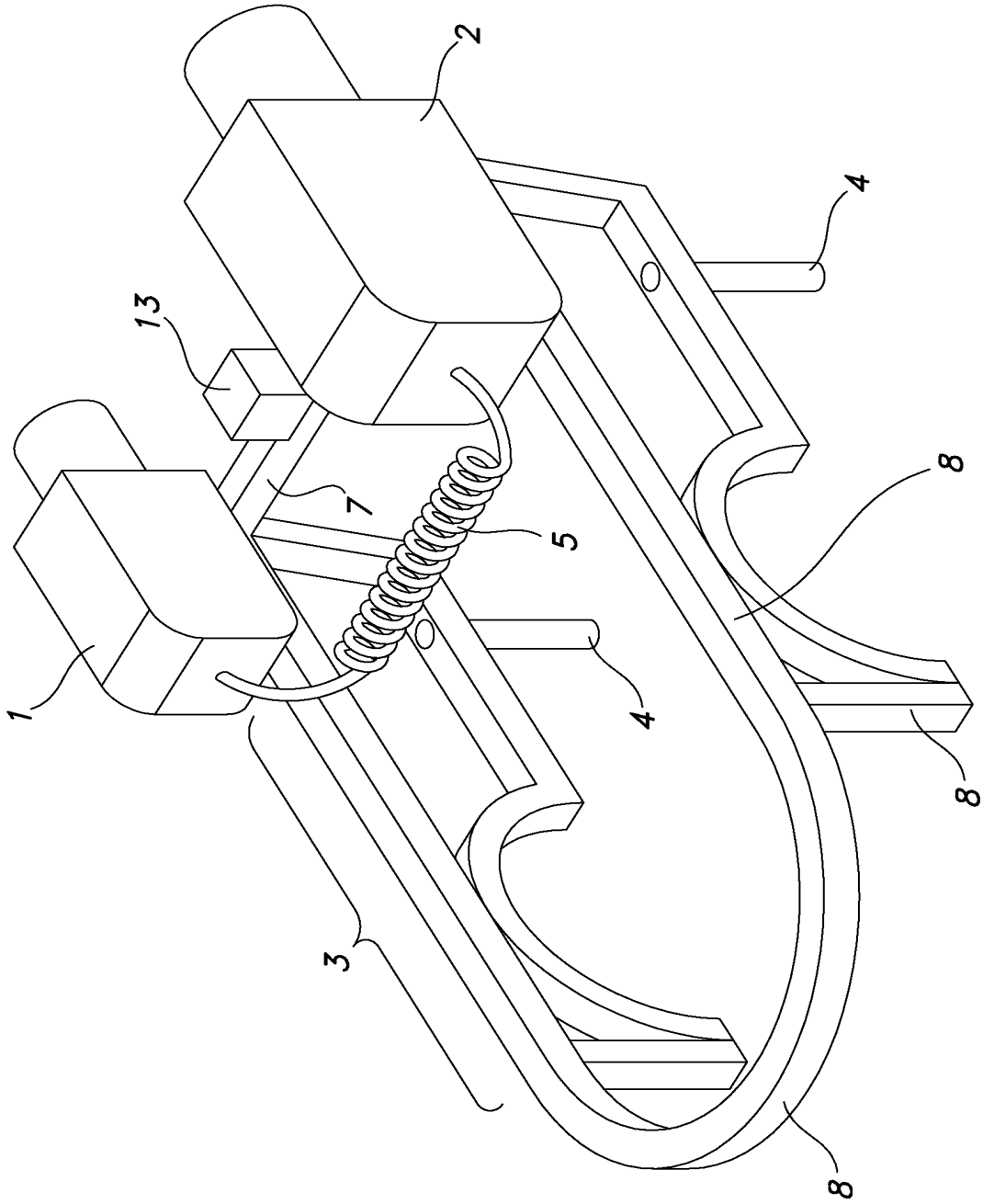

FIG. 1

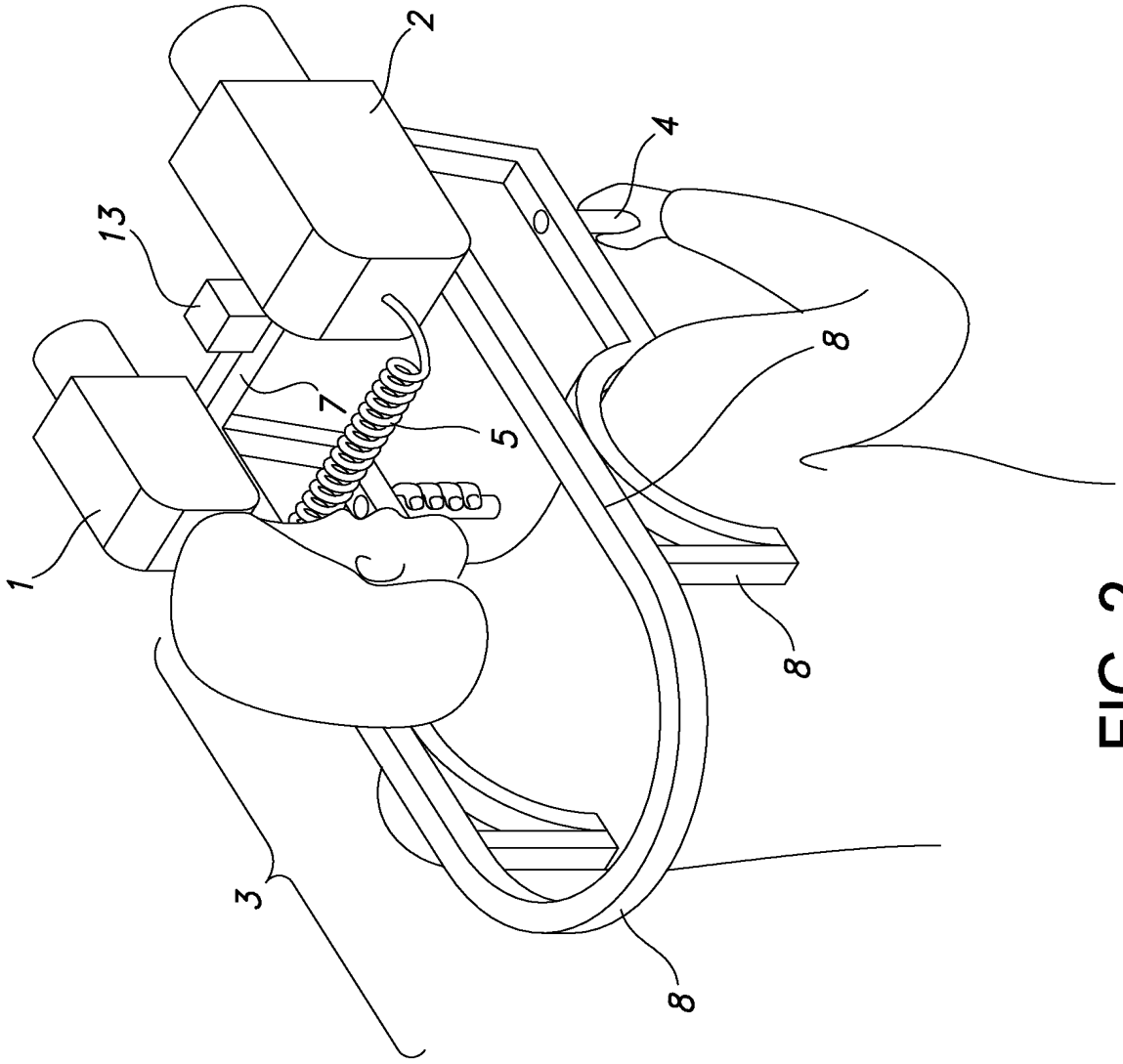

FIG. 2

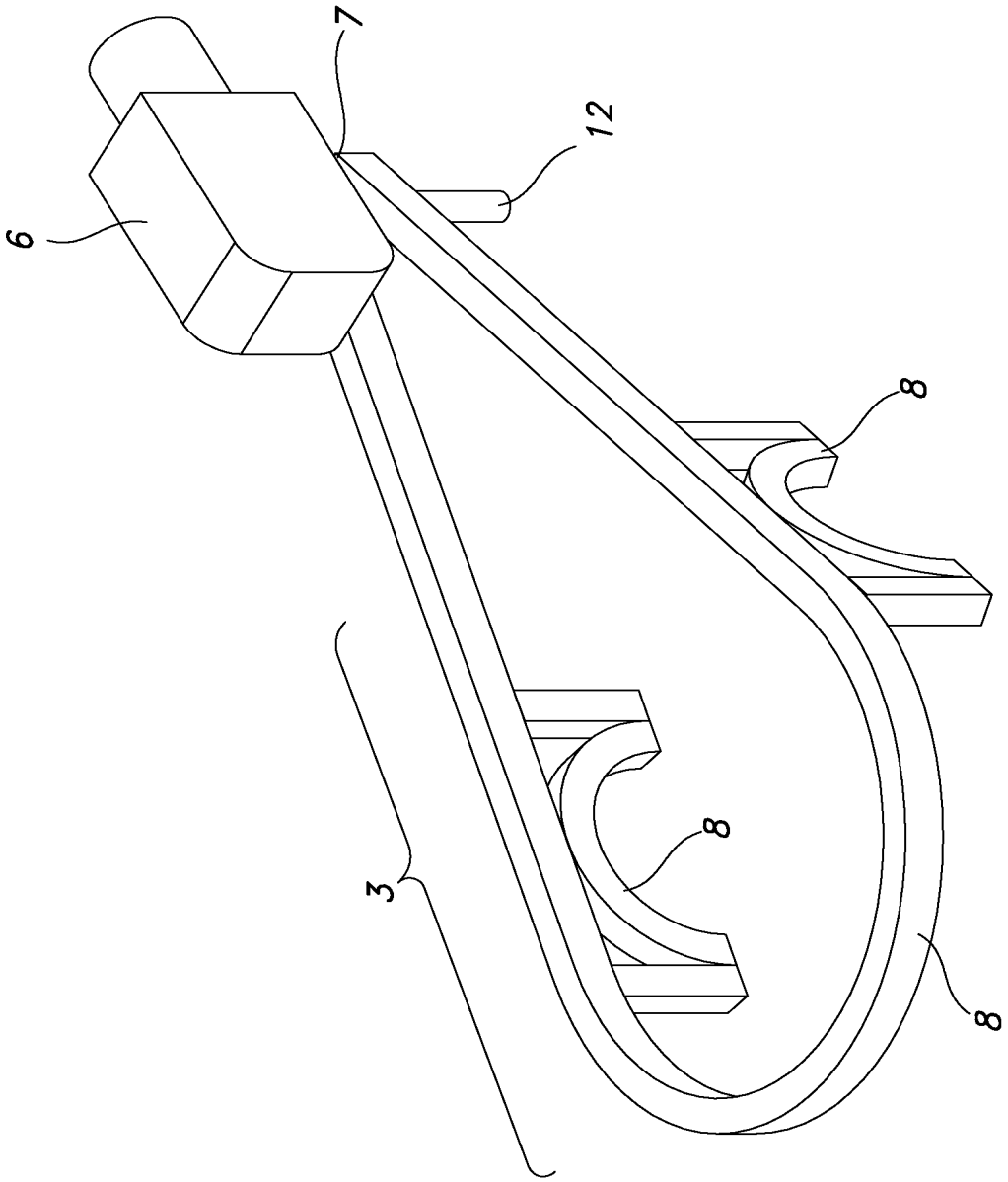

FIG. 3

FIG. 4A

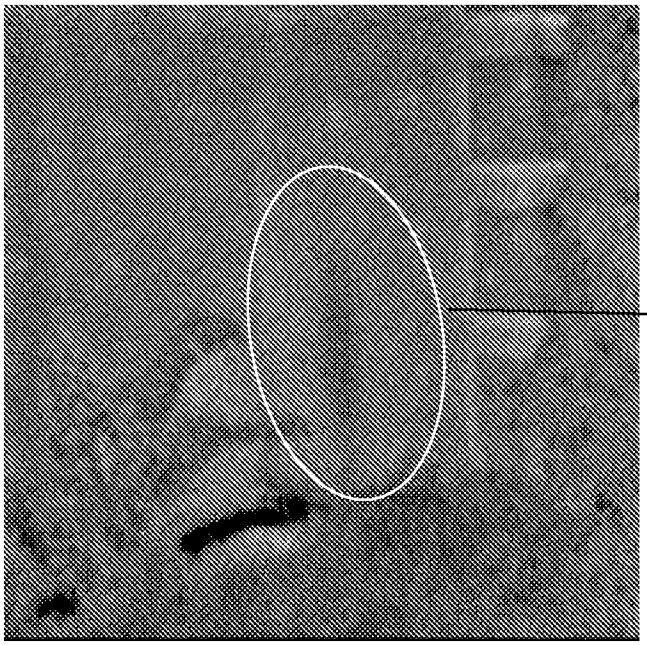

FIG. 4B

FIG. 5A

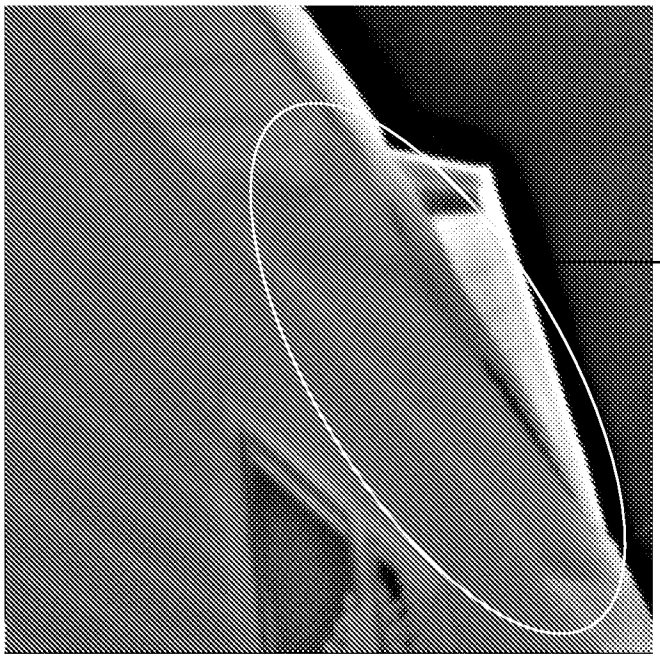

FIG. 5B

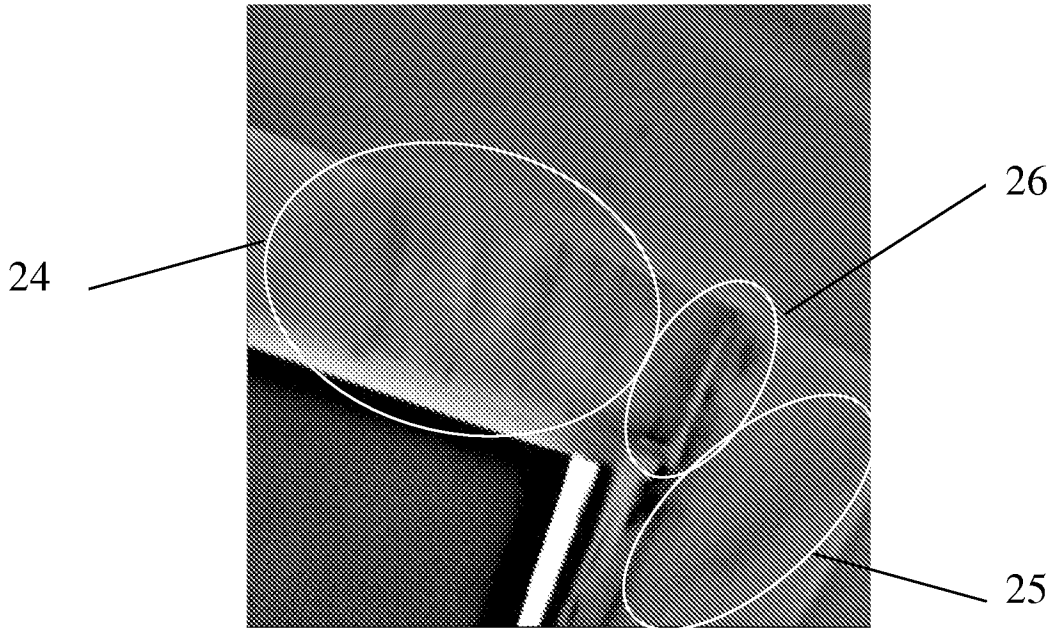

FIG. 6

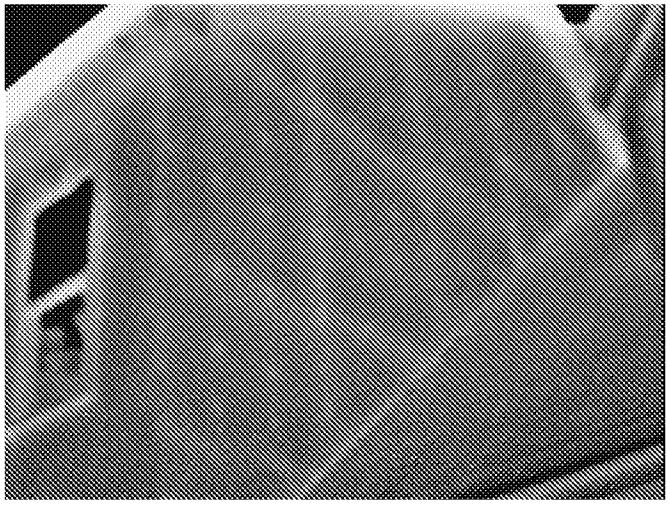

FIG. 7

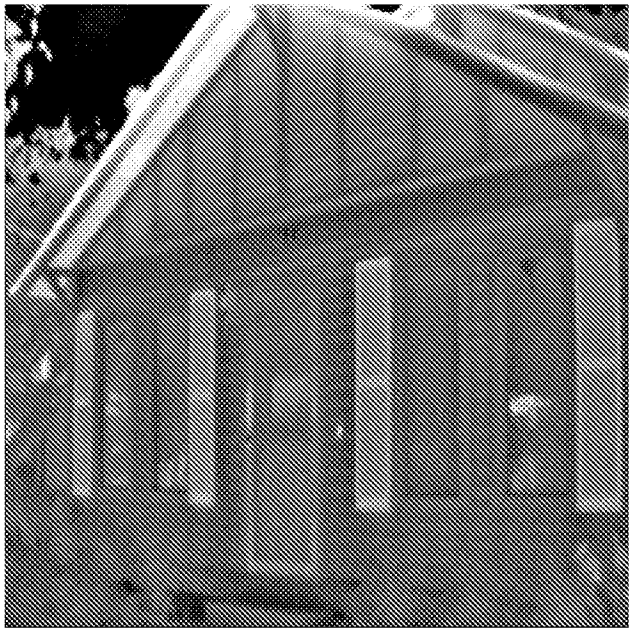

FIG. 8

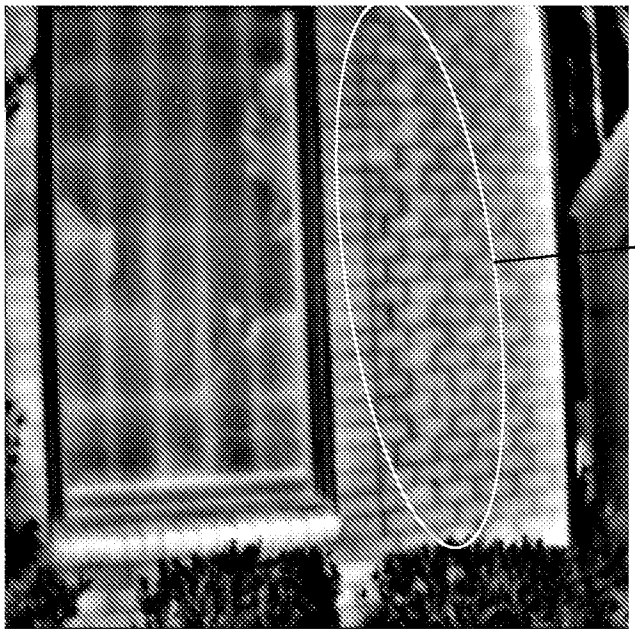

FIG. 9

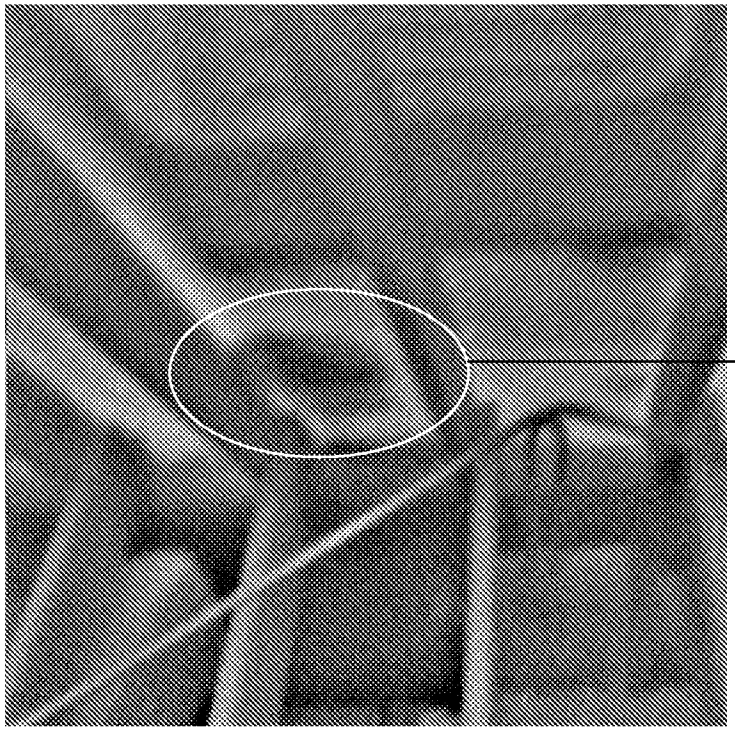

FIG. 10A

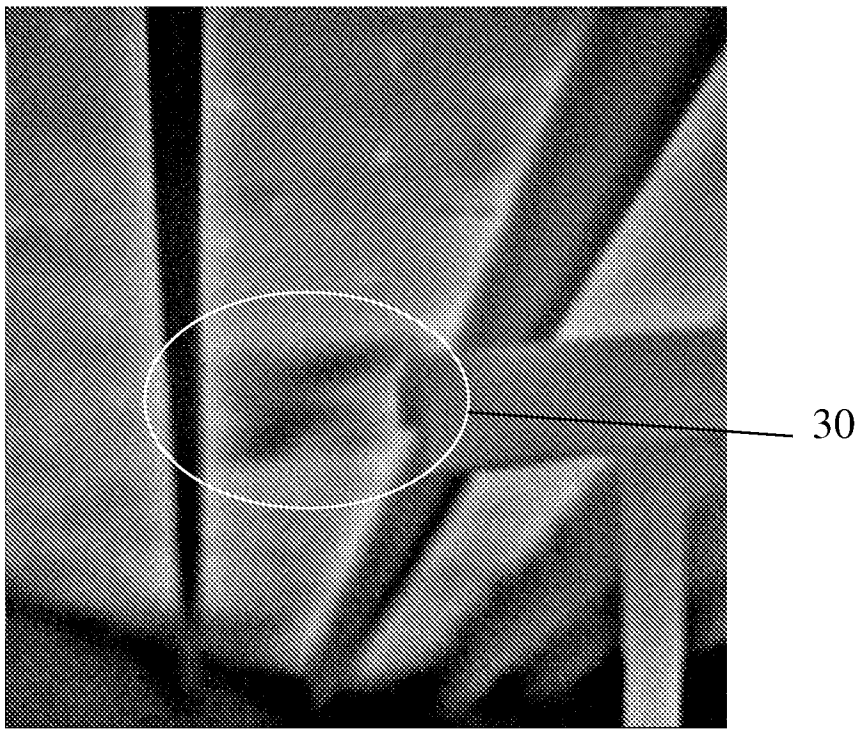

FIG. 10B

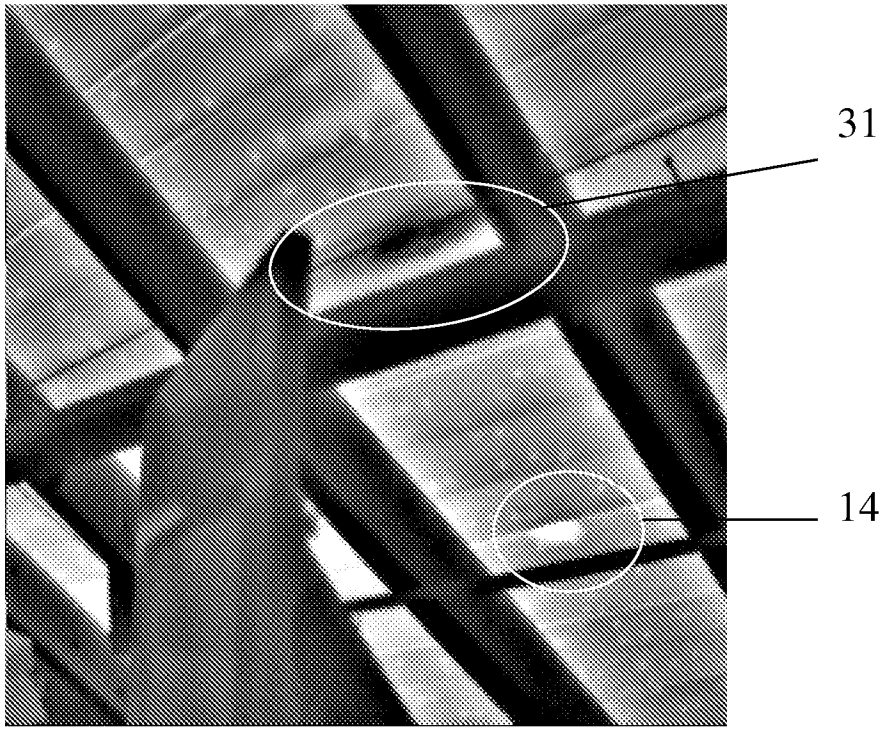

FIG. 10C

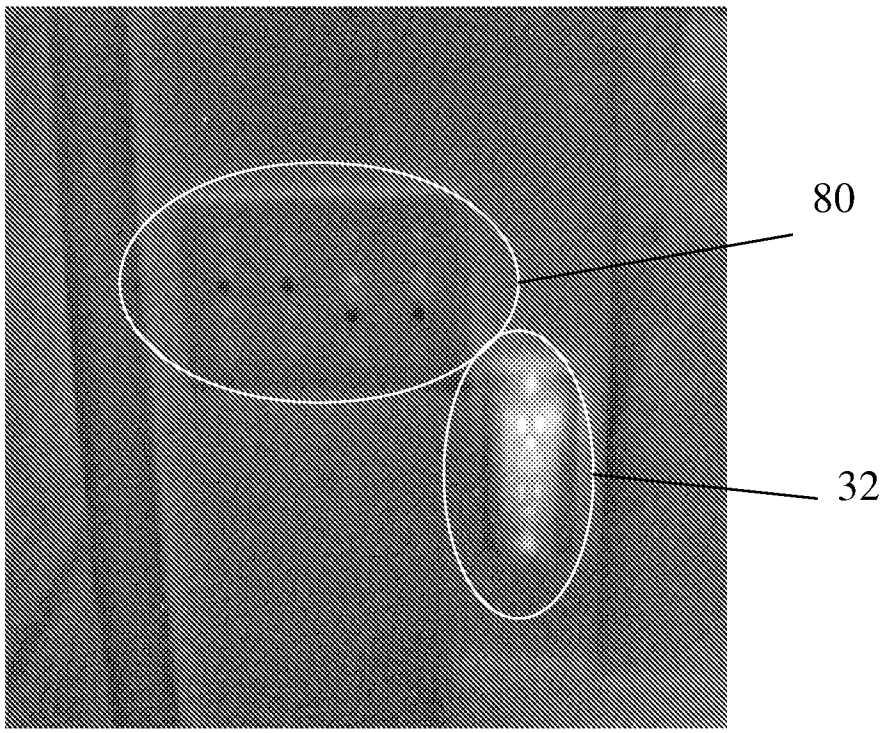

FIG. 11

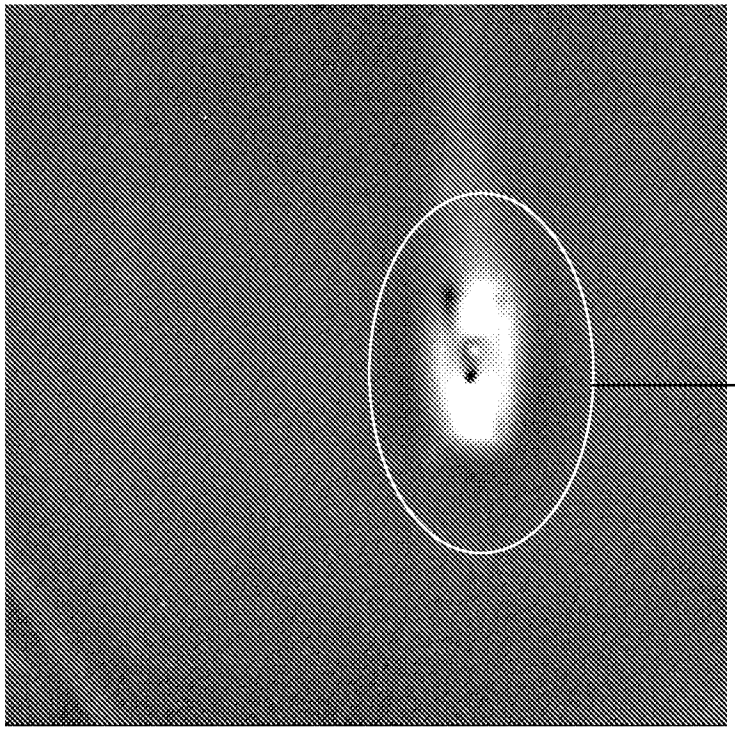

FIG. 12

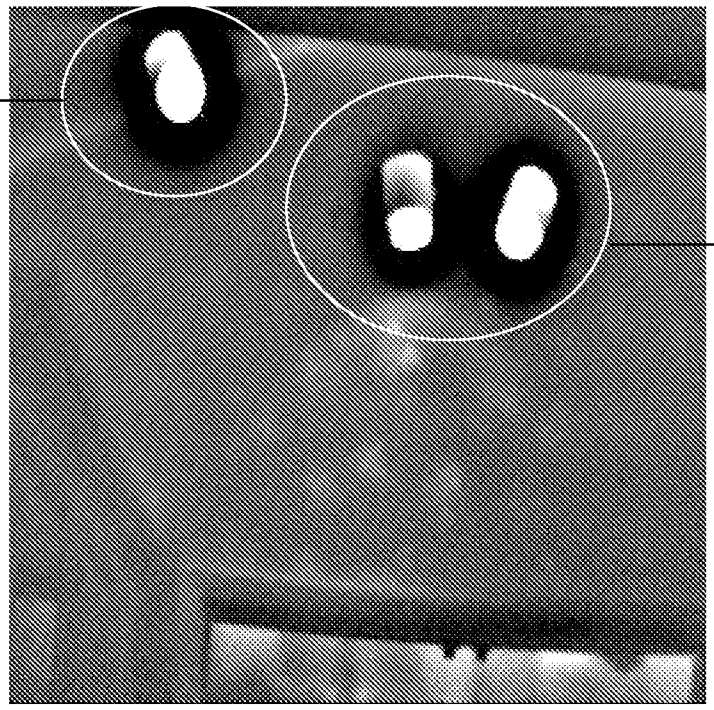

FIG. 13A

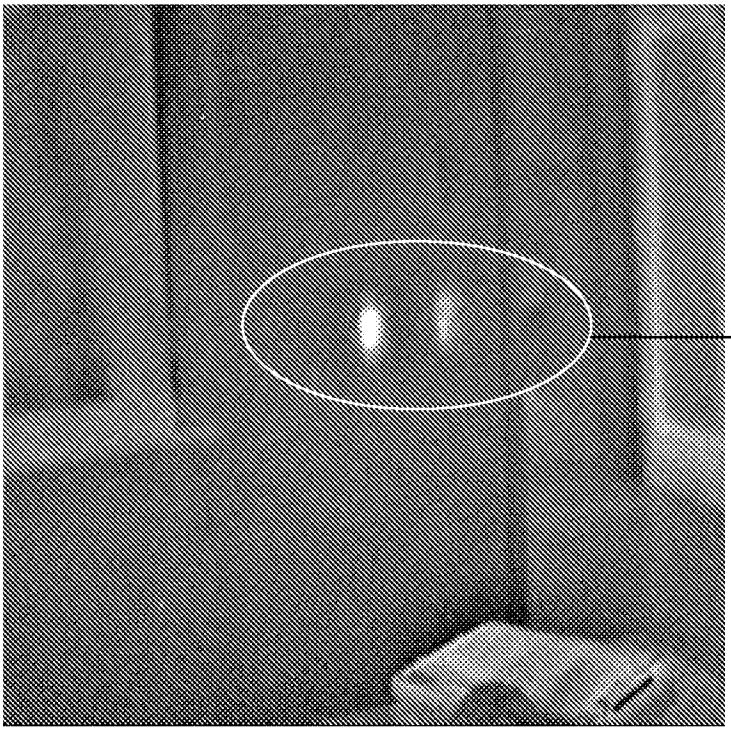

FIG. 13B

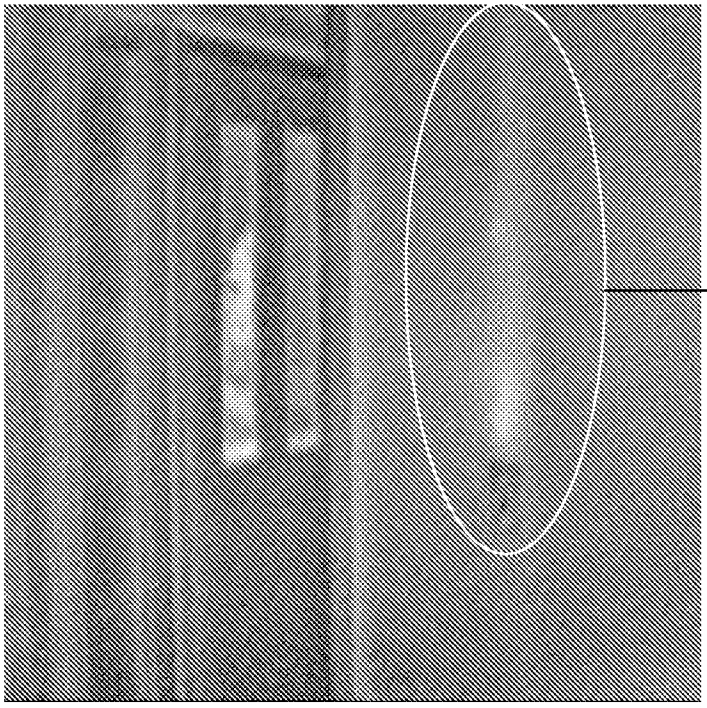

FIG. 13C

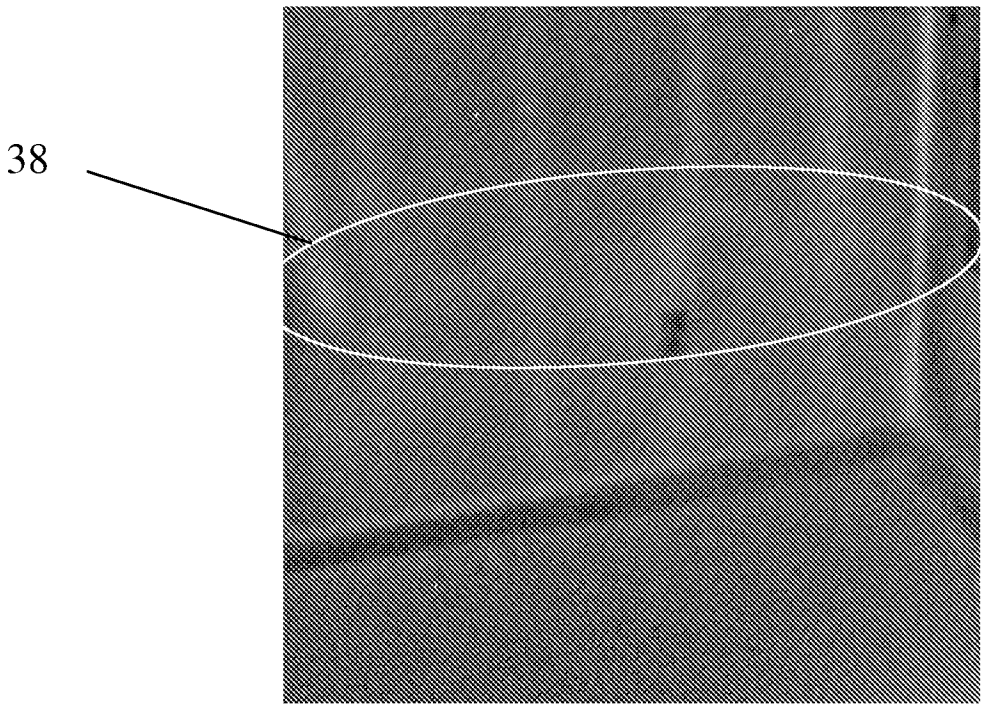

FIG. 13D

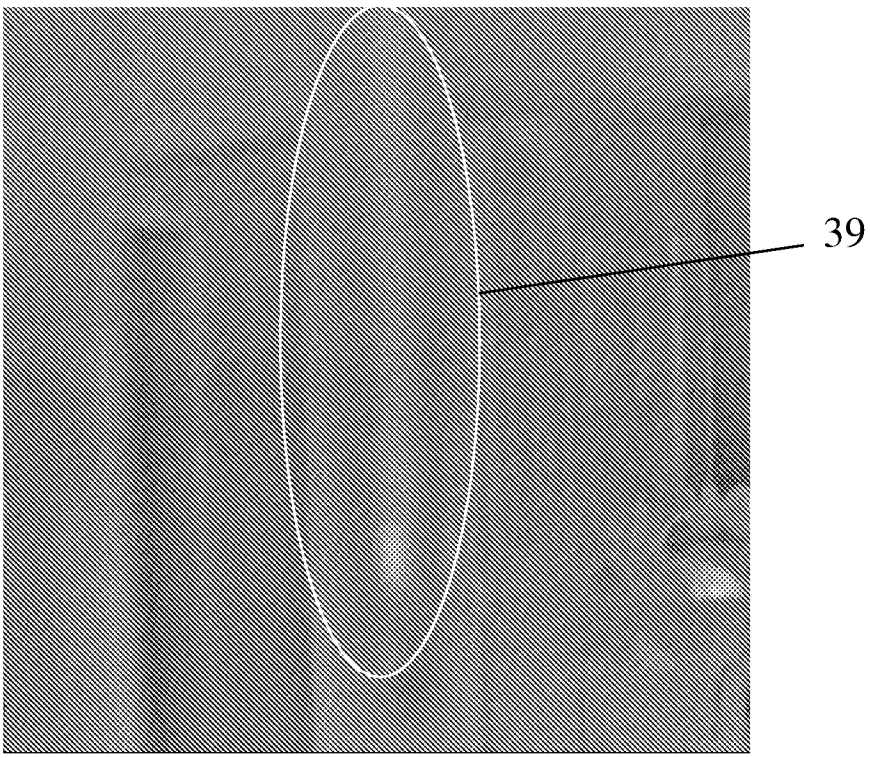

FIG. 13E

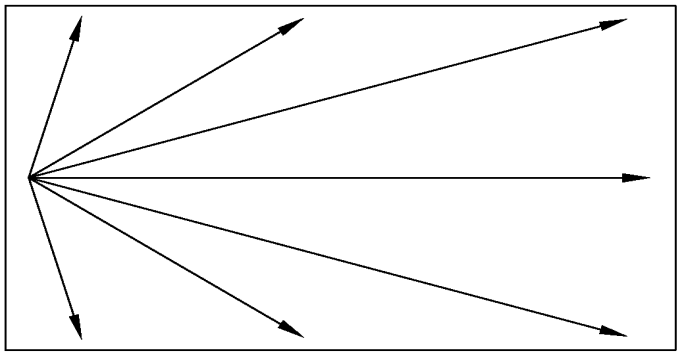

FIG. 14A

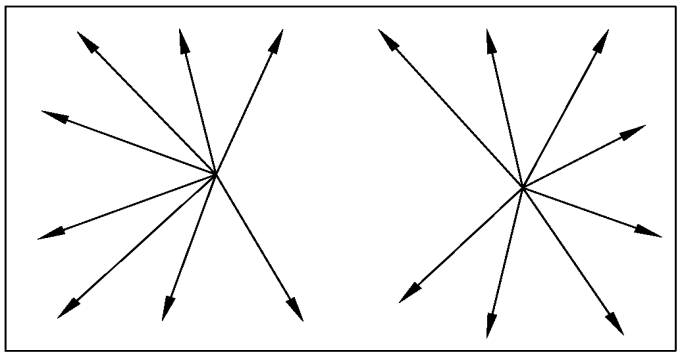

FIG. 14B

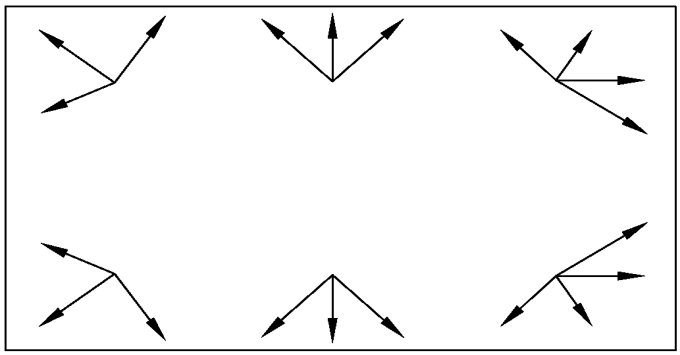

FIG. 14C

FIG. 15

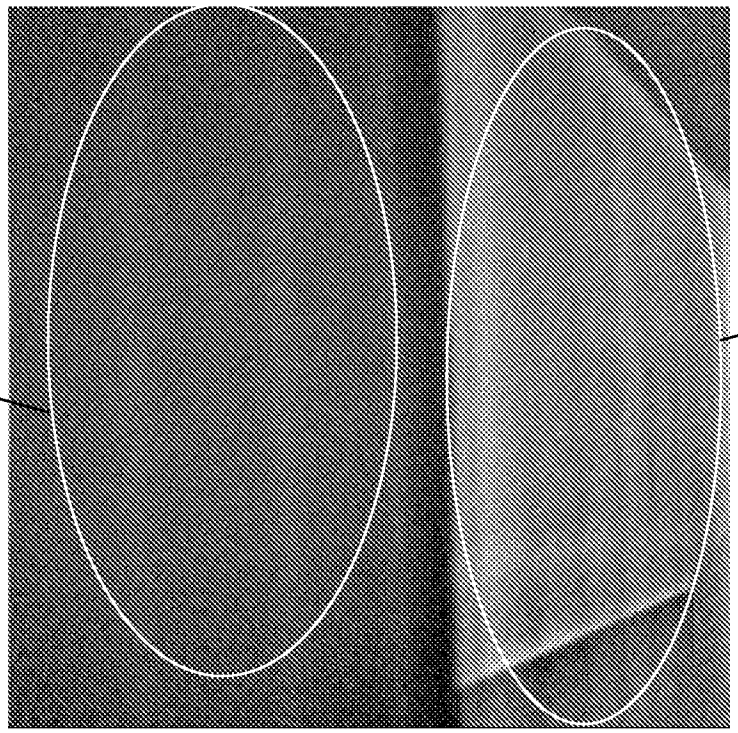

FIG. 16

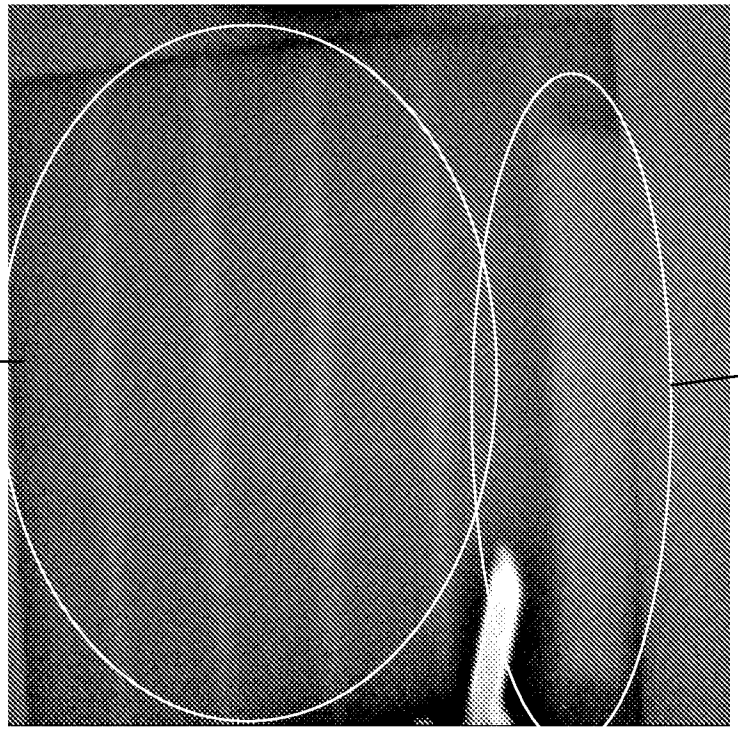

FIG. 17

FIG. 18

FIG. 19

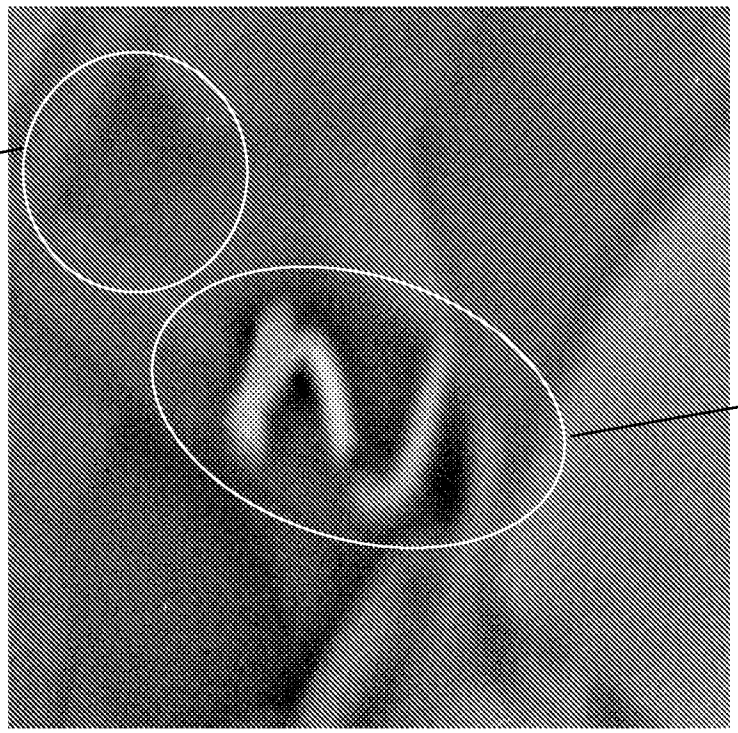

FIG. 20A

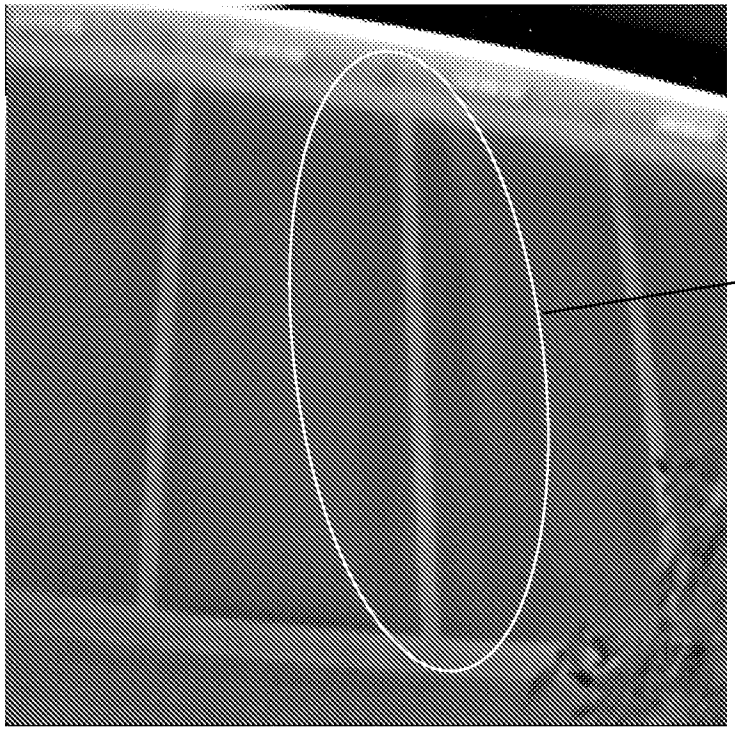

FIG. 20B

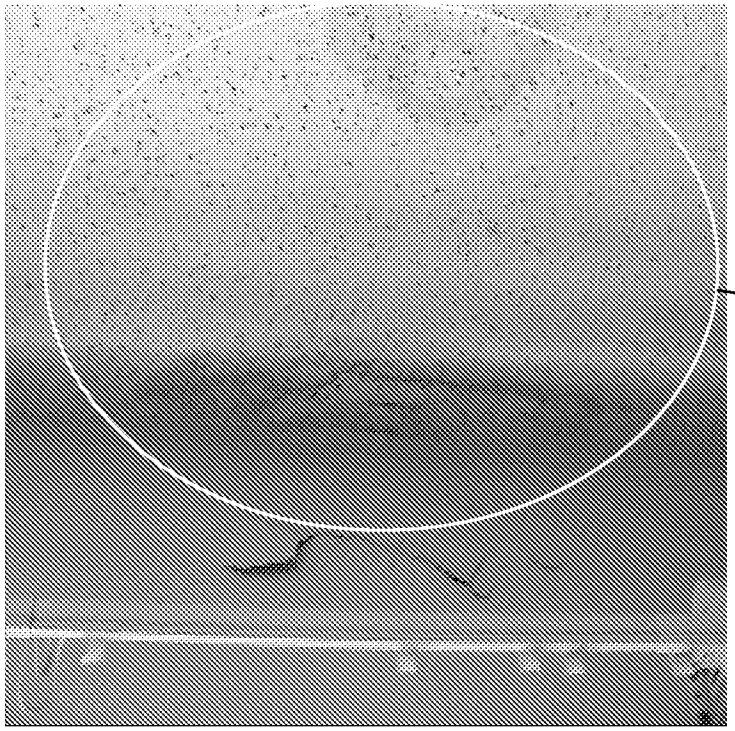

FIG. 21A

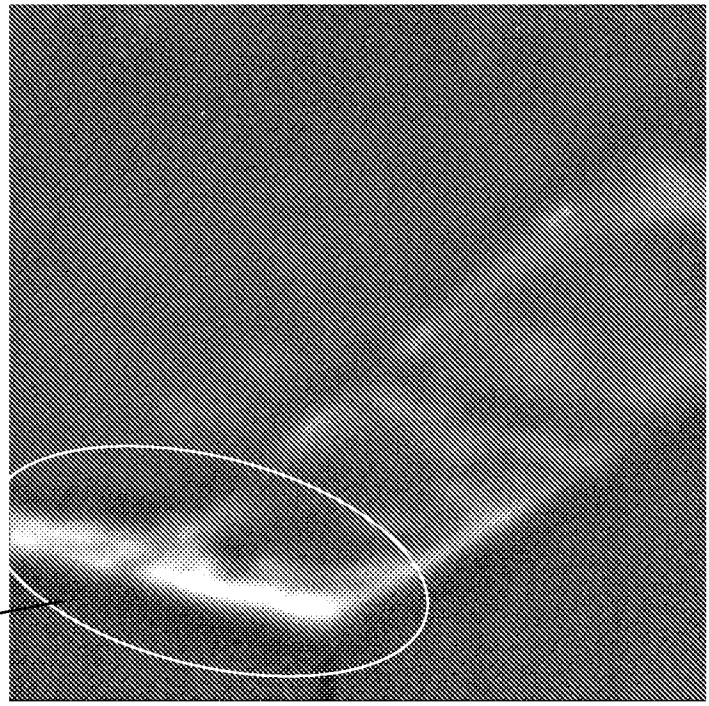

FIG. 21B

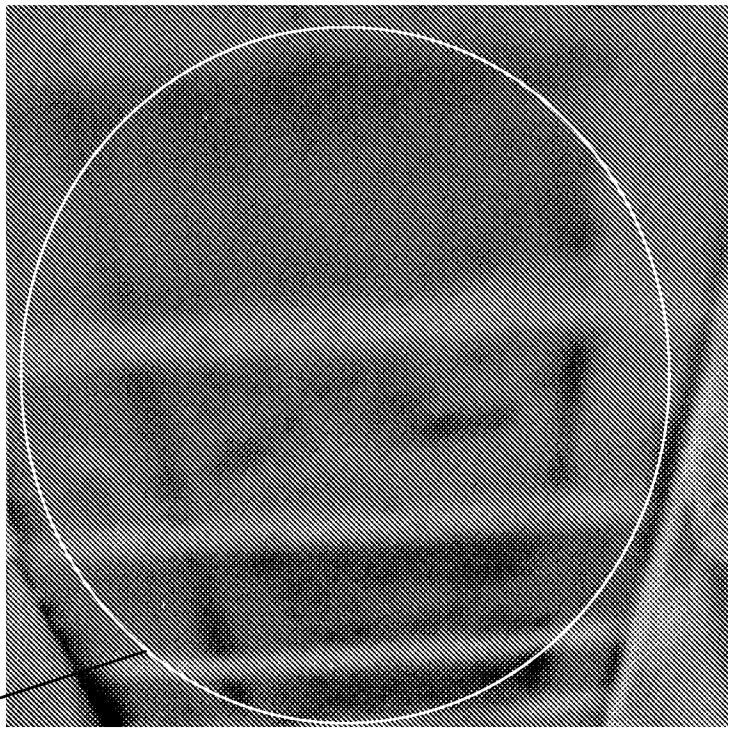

FIG. 21C

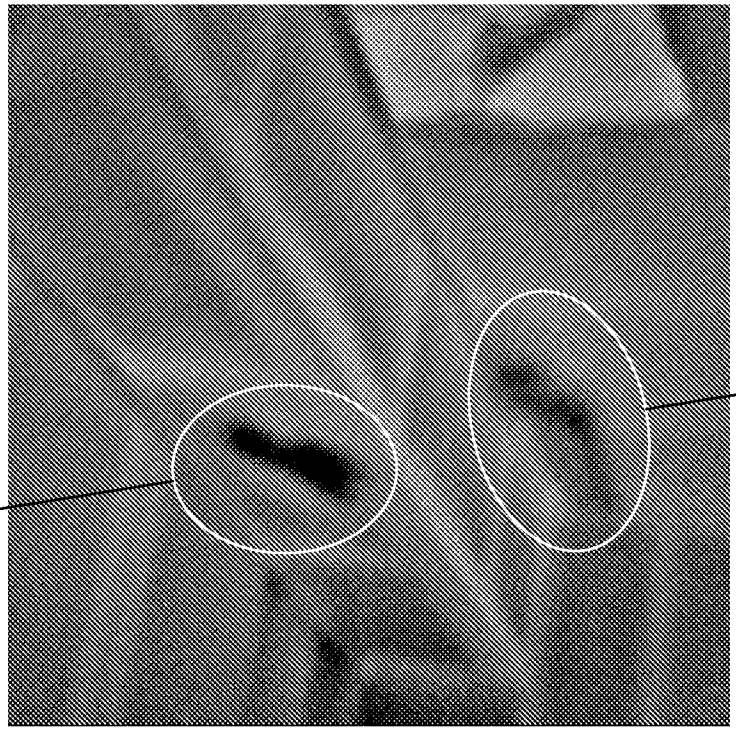

FIG. 21D

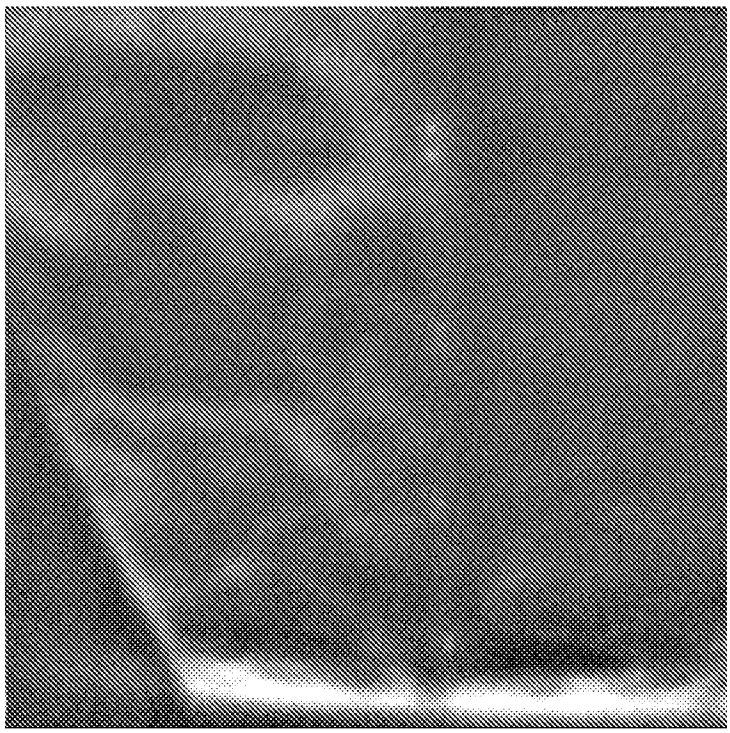

FIG. 22

FIG. 23

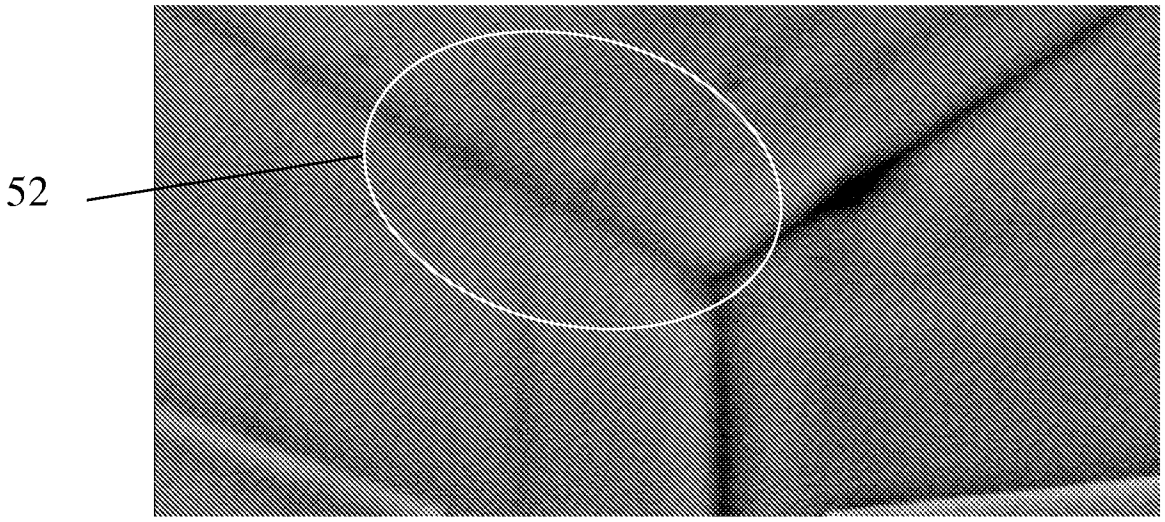

FIG. 24

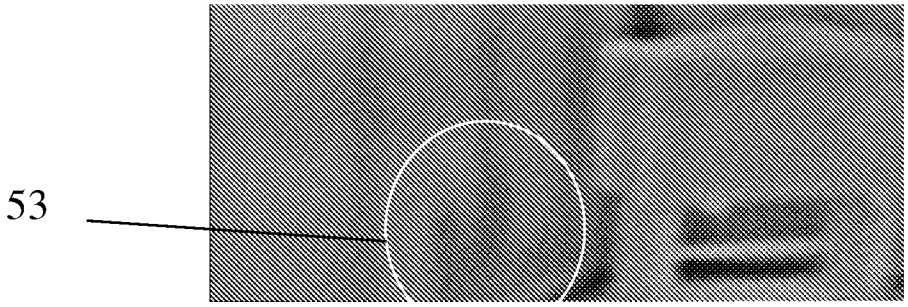

FIG. 25

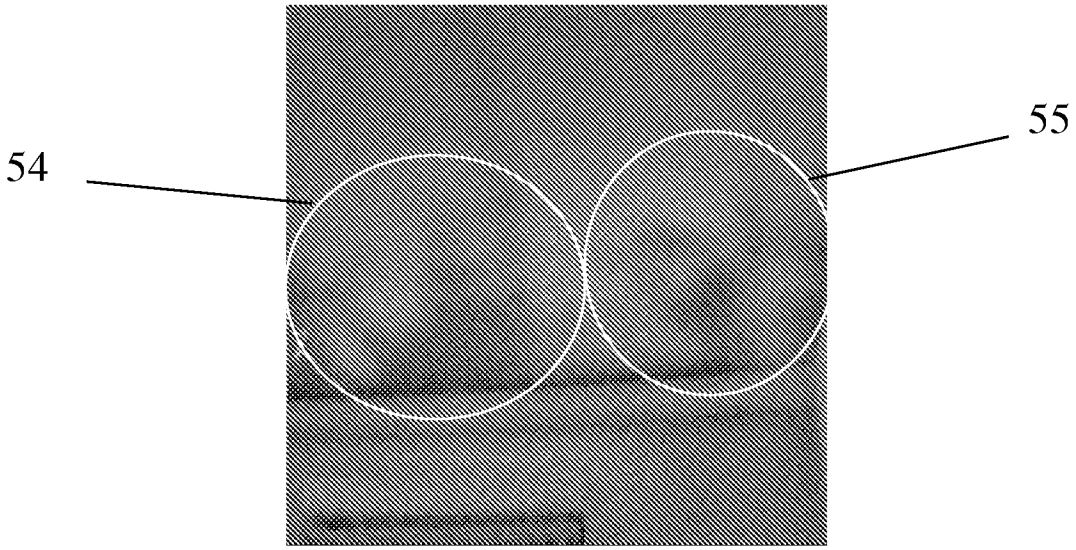

FIG. 26

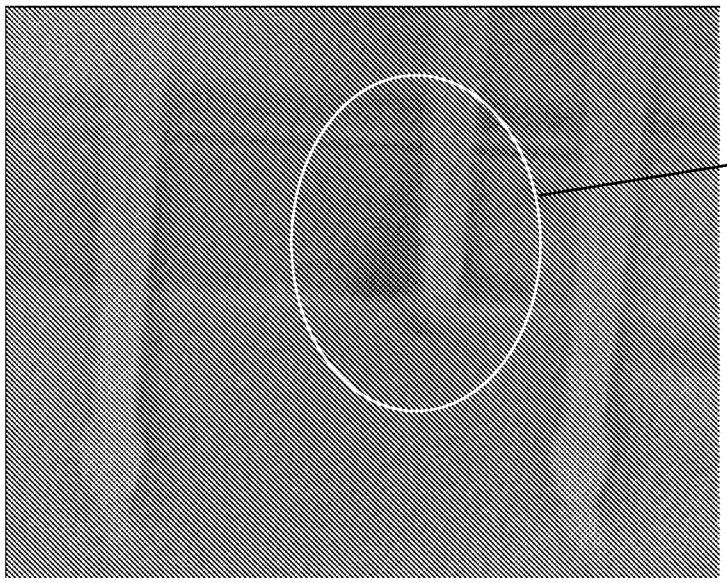

FIG. 27

FIG. 28

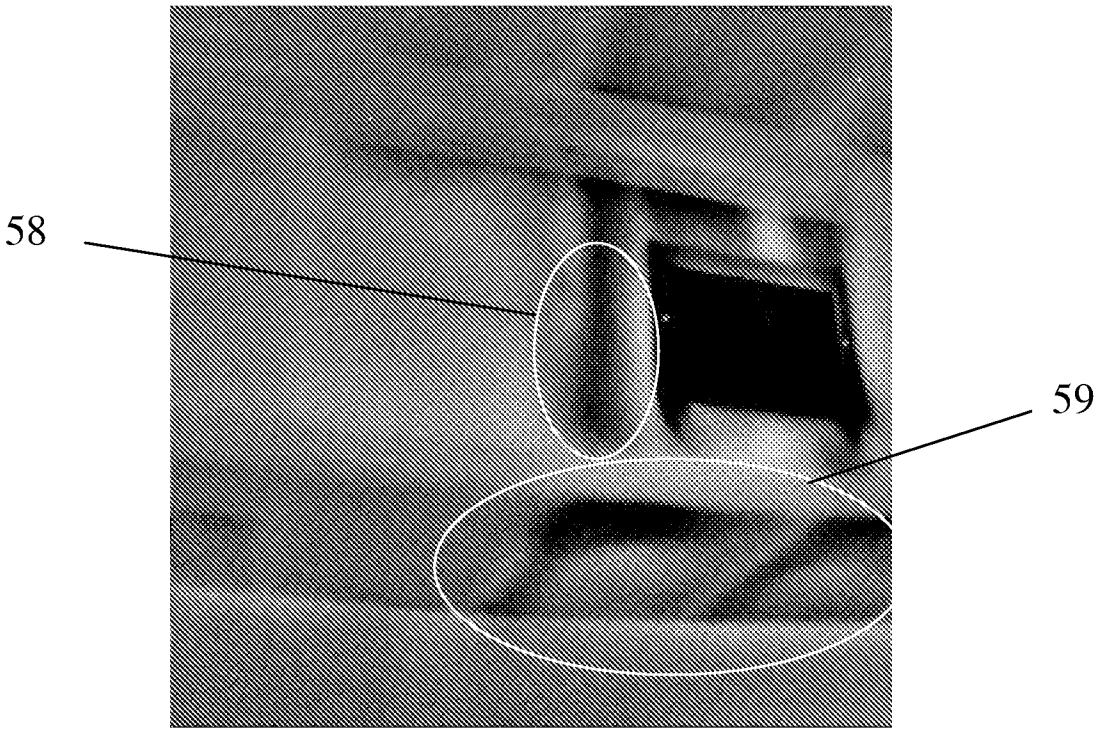

FIG. 29

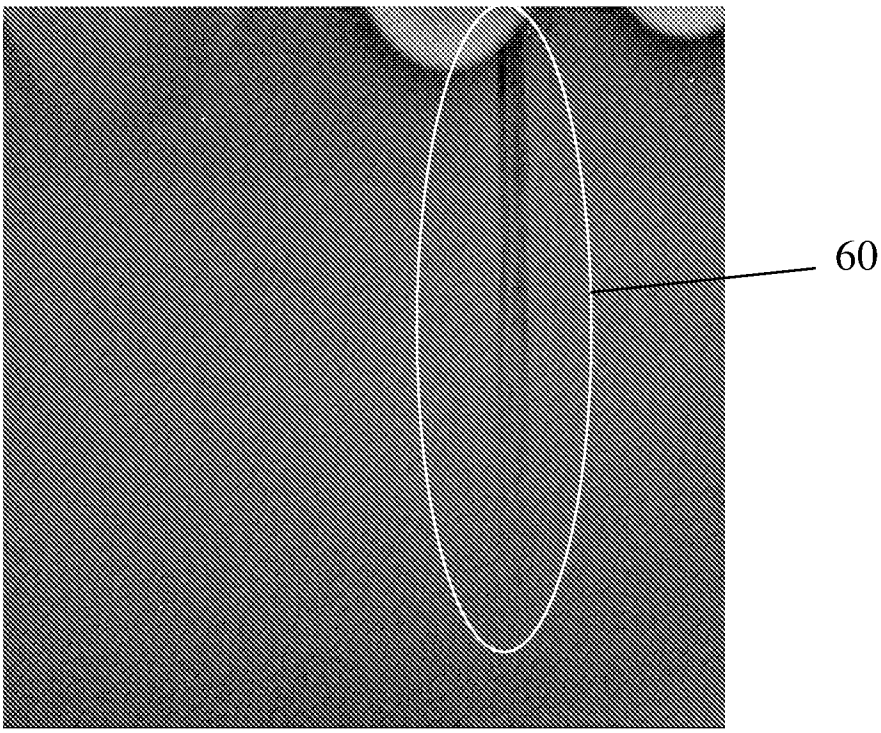

FIG. 30

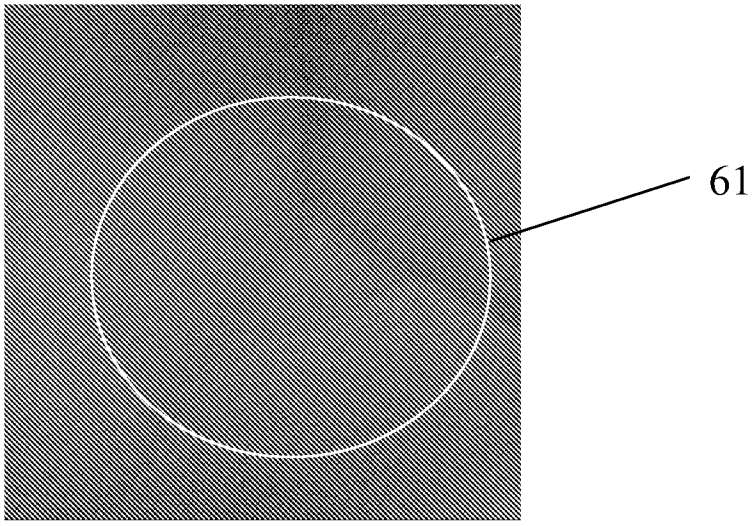

FIG. 31